BRITISH COLUMBIA

MINISTRY OF ENERGY AND MINES
MINING DIVISION

HISTORIC MINE SITES IN BRITISH COLUMBIA

By Lisa N. Barazzuol and
Gregg G. Stewart, PGeo

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CANADA

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EXECUTIVE SUMMARY

Mining has played a large role in the economic and social development of British Columbia for over 150 years. Over that time thousands of mineral deposits have been mined in the province. Many of these sites have been abandoned and their location and potential impacts are not comprehensively documented in government records. The principal concerns of these sites are environmental impacts to land and watercourses from acid rock drainage and metal leaching, and dangers to public health and safety presented by openings, shafts, tunnels and other underground workings that open to the surface.

In order to better understand the scope of the problem with old mine sites in the province, the Ministry of Energy and Mines undertook a program of fieldwork to document and characterize sites that showed indications of being problematic sites. These sites were identified through preliminary screening of available data in MINFILE[1] and through discussion with regional mine inspection staff. Fieldwork included inspecting over 60 sites across the province and documented deposit types, lithologies, mineralization, weathering characteristics of waste rock, mine infrastructure and water quality.

This report documents the work completed under this project in the 2000/2001 fiscal year. The results should be considered preliminary and are subject to change based on new information.

KEY FINDINGS

- Based on the definition of a historic mine site adopted by the project, there are approximately 1,887 historic mine sites in the province, primarily based on the data contained in MINFILE. (This number indicates sites in the province that do not have major *Mines Act* permits and where the production of mineral commodities has occurred historically).
- Of these, 1,171 sites are classified as mineral deposits known to have geoenvironmental characteristics with the potential for generating acid and leaching of metals.
- The 2000 field program included inspecting 62 sites, which accounts for approximately 3 percent of the identified historic mine sites in the province.
- Of these, approximately 6.5 percent are estimated to present potential environmental contaminants based on analytical water sampling results.
- Field visits are necessary to properly document location and adequately characterize a site regarding environmental and health and safety issues.
- Many sites are difficult or impossible to access due to their remoteness. This is compounded by the fact that road or trail access to historic sites no longer exists due to vegetative growth. These sites must be accessed via helicopter.
- Additional fieldwork is necessary before conclusive statements can be made regarding the status, risk and liability associated with historic mine sites in the province.

OPTIONS

- Provide funding for staffing and resources to continue to inventory historic mine sites in the province through a fieldwork program and office research.
- Provide for funding for staffing and resources for an enhanced project team to undertake fieldwork to continue to characterize historic mine sites in the province, undertake office research and develop appropriate legislation to help facilitate remediation of historic mine sites.
- Continue to work with the Mining Association of British Columbia and other resource agencies to further explore partnerships related to remediation of historic mines sites. This includes:
    - work-in-kind, expert advice and cost sharing;
    - investigate the development of "Good Samaritan" legislation with provisions for release of liability for individuals or companies undertaking remedial works at historic mine sites; and
    - consideration of tax relief for reclamation of historic mine sites.
- Develop programs to encourage re-mining of historic sites.

OTHER OPTIONS

- Focus efforts on known sites that are contributing to environmental degradation in the province. e.g. Britannia, Mt. Washington, Anyox.
- Consider government funded programs for historic mine site remediation.

ACKNOWLEDGEMENTS

Sincere thanks to the Mines Inspectors from the Regional Offices who facilitated the field inspections: Ken MacDonald (Prince George), Bruce Graff (Smithers), Steve Wuschke (Cranbrook), Steve Rothman (Kamloops) and Greg Carriere (Nanaimo). Gratitude is also extended to the Regional Offices for their assistance with transportation, especially the Prince George and Smithers offices, which provided ATV's and helicopter time respectively.

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[1] *MINFILE is a comprehensive database maintained by the Geological Survey Branch which documents over 12,000 known mineral occurrences in the province.*

Thanks to Diane Howe for her advice and help with the project, particularly the water sampling program. Thank you also to Mike Fournier for his GIS magic and Donna Launay for scanning photos. Thanks particularly go to Janet Holland for the destop publishing, which resulted in this valuable publication.

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INTRODUCTION

The province of British Columbia is richly endowed with mineral wealth. Mining has been central to the provincial economy beginning some 150 years ago, with the coal mines of Vancouver Island and the placer gold camps of the Cariboo. The mining of minerals such as gold, silver, copper, lead, zinc, molybdenum and many others has been an important source of jobs and government revenues. The long history of mining in British Columbia is also part of the rich cultural heritage of the province, and is largely the basis for the infrastructure upon which the province was built.

Generally there is a low level of knowledge about the location and impacts of historic mines in the province. Notable exceptions are Mt. Washington, Britannia, and Anyox, where there are documented environmental impacts. It must be recognized however, that a historic mine is not synonymous with the terms pollution or contaminated site. Each site has unique geological and environmental conditions and one cannot extrapolate a mine such as Britannia to every other historic/abandoned site in the province.

The regulation of the mining industry has evolved and improved with the maturing of the sector. Historic mining in the province was undertaken using less sophisticated methods than those currently used today by the high-tech and efficient mining industry and before enactment of modern environmental regulations. Mining undertaken prior to reclamation legislation has resulted in a number of historic (abandoned or orphaned) mine sites that have been left unreclaimed. These sites are not documented in a comprehensive manner in British Columbia. Understanding the historical evolution of mining in the province is important, as it allows the current situation regarding historic mine sites to be viewed with an informed perspective.

PROJECT OVERVIEW

PHASE 1 - 2000/01

Phase 1 of the Historic Mine Sites Project was initiated by the Ministry of Energy and Mines in May 2000 by the Reclamation Section of the Mining Division. The purpose of the initial year of this project was to begin to inventory historic mine sites in an effort to understand the scope of the problem in British Columbia and to develop a Historic Mine Sites Database (HMSDB).

Sites were identified principally through review of existing ministry data and developing a working definition of a historic mine site. Initial classification of historic mine sites included 1,887 unpermitted, "past producing" mines in the province, based on information contained in MINFILE (database of all known mineral occurrences in British Columbia). Further prioritization of sites included mineral deposits known to have geoenvironmental characteristics, which present a potential for generating acid and/or leaching of metals into the environment. Of this type, there are 1,171 identifiable sites in the Province.

Further site prioritization for fieldwork was based on the size of the workings, degree of documentation on metal leaching/acid rock drainage (ML/ARD) issues, discussion with regional Ministry of Mines staff and accessibility. Access to many of these sites is costly due to remoteness and the fact that vehicle access is not possible.

Field based inspections were conducted primarily in July, August and September 2000, including sites from all regions of the province. This work was undertaken with mines inspectors from each regional office in order to provide logistical support, and to rely on their experience and knowledge of the historic sites in their region. To date, about 62 sites have been inspected, which included sampling of mine drainage for analysis of heavy metal content as well as other documentation of site specific information. This, however, represents only about 3.0% of the 1,887 identified historic sites in the province.

Many other provincial jurisdictions across Canada are undertaking similar studies that include locating, inventorying, characterizing and reclaiming historic/abandoned mine sites in Manitoba, Ontario, Quebec and Nova Scotia. Major mine rehabilitation programs are also being undertaken in the United States and Australia.

LONG-TERM OBJECTIVES

Long-term objectives of this project include identifying high priority sites where environmental or health and safety issues exist, and determining where reclamation is necessary. This however, will require more fieldwork to characterize sites in order to have a higher level of confidence that the sites requiring reclamation are identified.

The Ministry has initiated preliminary discussions with other resource agencies and the mining industry to develop a common strategy in order to facilitate addressing the issues of historic mine sites in British Columbia. This includes identifying persons having known responsibility to clean up sites and identifying those sites that are truly orphaned and may require government funding or partnership programs to facilitate cleanup.

The benefits gained from reclamation of historic mine sites include protection of life, health, and safety, improved environmental and social conditions, and better use of natural resources.

LEGACY OF MINING IN BRITISH COLUMBIA

The mineral resources in British Columbia are owned by the Crown provincial. This ownership stems from the terms of Confederation in which the Canadian provinces retained ownership over natural resources contained within their respective boundaries, and the right to exercise control over resource developments.

In most jurisdictions in North America where ownership of mineral resources have been retained by the public sector, governments do not explore for, develop and produce these resources. Such activities are carried out by the private sector-the mining industry-which raises cash required to search and develop sub-surface resources.

British Columbia has an impressive mineral endowment. Mining for metals and coal has been ongoing since the mid-1800s and has resulted in billions of dollars worth of production. The scale of this contribution is not always apparent; it lies buried in dry statistics on employment and international trade. In 1999 mineral production of solid minerals in British Columbia created $2.6 billion of new wealth (estimate 1999-MEM Mineral Statistics).

Mining has also had a major influence on the economic and social development of British Columbia. This influence commenced prior to the establishment of the province as a jurisdiction, and was instrumental in developing transportation and access routes from tidewater to the interior. As the mineral wealth of the province became recognized and the focus of mining shifted from placer gold to lode deposits of precious and base metals, mining activities, including processing of ores became a significant regional employer. This aspect of mining has continued to the present day.

A second noteworthy aspect of mineral development in British Columbia has been the historical importance of the southern third of the province. Ease of access using the north-south river systems, favourable geological environments and the presence of a trained cadre of prospectors and miners gave the south-east portion of the province an early start in successful mineral developments. This success was replicated in the south-central regions and along the coast, resulting in a multitude of mining operations of varying sizes.

Most of British Columbia's mines today are far from big cities and most city dwellers have never seen one. Even fewer have actually visited a mining operation. Many of us think of mines only as dark, damp and dangerous places, benefiting no one but the owners at the expense of irreversible damage to the environment. The industry, however, presently provides jobs for over 11,000 people, and thousands more work for employers who depend on it for a significant part of their business. In many cases the link is obvious, as with trucking, railways and port operations; in others less so, as in banking, financial services, and wholesale and retail trade.

The connection between mining and quality of life is rarely made. Mining provides the raw materials from which virtually all essential products are made. For example, iron ore and coal combine to provide steel, a basic component of modern living. Homes, buildings, electrical power, farm machinery, cars, computers, kitchen appliances and hundreds of thousands of other familiar products are processed from minerals.

Since the gold rush 150 years ago, thousands of mines have been developed. Many of these mines were immediately abandoned when insufficient minerals were found, others where abandoned later when poor economics of the commodity made mining unprofitable, while others where abandoned for reasons only known to the miners. The result is that British Columbia's landscape contains many historic mine sites that are not comprehensively documented or characterized.

Past mining practices paid little attention to the environment. We should realize that as our forefathers opened up vast areas of the province to settlement in the first half of the century, the natural resources, the forests, the minerals and the fishery, appeared limitless. Modern concepts of conservation would have been laughed at and it could not possibly have occurred to miners of the day that the results of their efforts to wrest a living from an unforgiving land might be looked at with disfavour by future generations.

Today, planning for environmental protection and ultimate reclamation of mining lands is a prerequisite for obtaining government approval to go ahead with a new mining project. Understanding the historical development of mining in British Columbia will however, help us place into perspective what has happened in the past, and better prepare us to make reasoned decisions in developing management practices for historic mine sites in British Columbia in the future.

OVERVIEW OF MINES ACT IN BRITISH COLUMBIA

British Columbia was one of the first jurisdictions in Canada to enact mine reclamation legislation and the first to extend this policy to exploration sites. Due to the leadership exercised by the government, the mining industry and, later, the exploration sector, British Columbia's mining industry has become widely recognized for its achievements in mine reclamation.

History of Legislation

Reclamation legislation was first enacted in 1969 when existing mining legislation was amended, requiring reclamation for major coal mines and hardrock mineral mines.

In 1973, legislation was amended to include coal exploration, mineral exploration, sand and gravel pits and quarries.

In 1984, the Minister of Energy, Mines and Petroleum Resources published reclamation guidelines.

The *Mines Act* remained relatively unchanged until it was amended in 1990. This amended Act and its accompanying Health, Safety and Reclamation Code for mines in British Columbia (Code) continues to provide the framework for reclamation policy.

Part 11 of the Code (the Mineral Exploration Code) was amended in 1997 and contains standards for mineral and coal exploration activities, and a streamlined process for permitting these activities.

Although the *Mines Act* has remained constant during the 1990's, there have been a number of significant guideline and policy initiatives, which have been developed and are complimentary to the legislation. Some of these include:

Mine Reclamation Security Policy in British Columbia. Ministry of Energy, Mines and Petroleum Resources, February 1995.

Policy for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia. Ministry of Energy and Mines and Ministry of Environment, Lands and Parks, July 1998.

Guidelines for Metal Leaching and Acid Rock Drainage at Mine Sites in British Columbia. Ministry of Energy and Mines, August 1998.

Application Requirements for a Permit Approving the Mine Plan and Reclamation Program Pursuant to the Mines Act. Ministry of Energy and Mines, March 1998.

Current Policy Framework

Standards for mine reclamation are described in Part 10 of the Code and pertain largely to major coal and metal mines. These standards define mine reclamation, and include provisions for returning the land and watercourses to a productive end land use, ensuring that impoundment structures and waste rock dumps are stable over the long-term, and ensuring that water quality released from a mine site is of an acceptable standard.

Mining

Mining, especially open pit metal mining, has an intense impact in a relatively small area of the provincial land base. For example, for every kilogram of copper produced in British Columbia there may be 200 kilograms of waste rock excavated and stored in waste dumps and another 200 kilograms of tailings. The environmental acceptability of mining hinges on being able to confine these impacts to a limited area and, following closure, to achieve an acceptable reclamation standard.

For major mines, the Ministry's philosophy is to set broad reclamation standards which allow each company to develop their own program on a site-by-site basis. The standards set out in the *Mines Act* and accompanying Code maintain this philosophy. They were produced following considerable discussion with industry and other government agencies.

Since reclamation legislation was first introduced, companies have now largely integrated their reclamation planning into the overall mine planning process.

Environmental Assessment Process

The *Environmental Assessment Act* (EAA) was proclaimed on June 30, 1995. It replaced the Mine Development Review Process and applies to new mine developments (or modifications to existing mines) meeting threshold criteria established under the EAA. The EAA establishes a single, comprehensive provincial review and approval process. It is intended to provide a means of identifying potential effects of major projects and an evaluation of opportunities to prevent or mitigate impacts.

Mines Act Permitting Process

The permit system itself has remained relatively unchanged since 1969 and provides for:

A Reclamation report - to be submitted prior to commencement of operations outlining a program for the protection and reclamation of the land and watercourses affected by the mine.

Publication of a Notice of Filing in the B.C. Gazette and local newspapers - this is a requirement for major mines and, depending on the level of public concern, can be required for exploration activities or placer mines.

Report review - by an inter-agency committee of government. The Regional Mine Development Review

Committees provide the detailed technical review, and the Victoria-based Reclamation Advisory Committee is the coordinating body.

Reclamation security - originally, bonds to secure mine reclamation obligations where limited to $1,000.00, and then $2,500.00, per hectare. This cap was not eliminated until 1990, when the *Mines Act* was amended and the Code came into effect. Reclamation security is now a condition of a *Mines Act* Permit and is in an amount, form, and subject to conditions specified by the Chief Inspector. Over the last several years, reclamation security bonds have been increased on many properties, as permits have been issued or amended. This policy reflects government's desire to reduce the possibility that public funds may be required to reclaim a mine in the case of company default, by more accurately reflecting outstanding reclamation obligations of each mine property. Additionally, recognition of ML/ARD as a significant environmental issue has occurred within the past decade.

The *Mines Act* also makes provision for a mine-specific reclamation fund which enables companies to set aside money today for obligations which are being incurred (such as acid mine drainage) that will require funds to be expended at some future date.

More information about the *Mines Act*, **the Code, the Environmental Assessment Process and the permitting process can be found on the Ministry's web site, at http://www.gov.bc.ca/em.**

HISTORIC MINE SITES

Mining has taken place in British Columbia since the mid-1800s, however, reclamation requirements were not legislated until 1969. This has resulted in a number of old mining sites, which were not reclaimed when operations ceased. In many cases, nature has successfully undertaken this function and the surface disturbance at many sites is no longer visible. In other cases, the mines are of historic significance and the remnants of mining are protected and preserved.

Although the Ministry has extensive records on exploration and mining activity dating back to the previous century, much of this information is not consolidated in a readily accessible database. At present there are only a few known historic sites considered likely to require significant remedial action to mitigate environmental damage; however, one of the principle objectives of the Historic Mine Sites project is to determine if other sites in the province warrant attention.

Historic Mine Sites Database

The HMSDB (Figure 1) was built using Microsoft Access as the platform and was designed to incorporate geological, geochemical, geotechnical and administrative information for each site. The strength of the database is the ability of the user to input a wide range of data sources and the ease at which detailed queries can be performed.

The primary purpose of the database is to house an inventory of historic mine sites containing technical information, which characterizes sites. A secondary purpose of the database is to collect technical data on operating mines, which have been permitted by the Ministry to assist in regulatory functions. The database is currently a 'work in progress' as it is still being tested, amended and updated.

Constructing the Historic Mine Sites Database

Construction of the HMSDB was performed in three steps:

- extracting records from MINFILE.
- matching *Mines Act* permits to the extracted MINFILE records;
- data entry of technical information for each site (ongoing).

Extracting Records from MINFILE

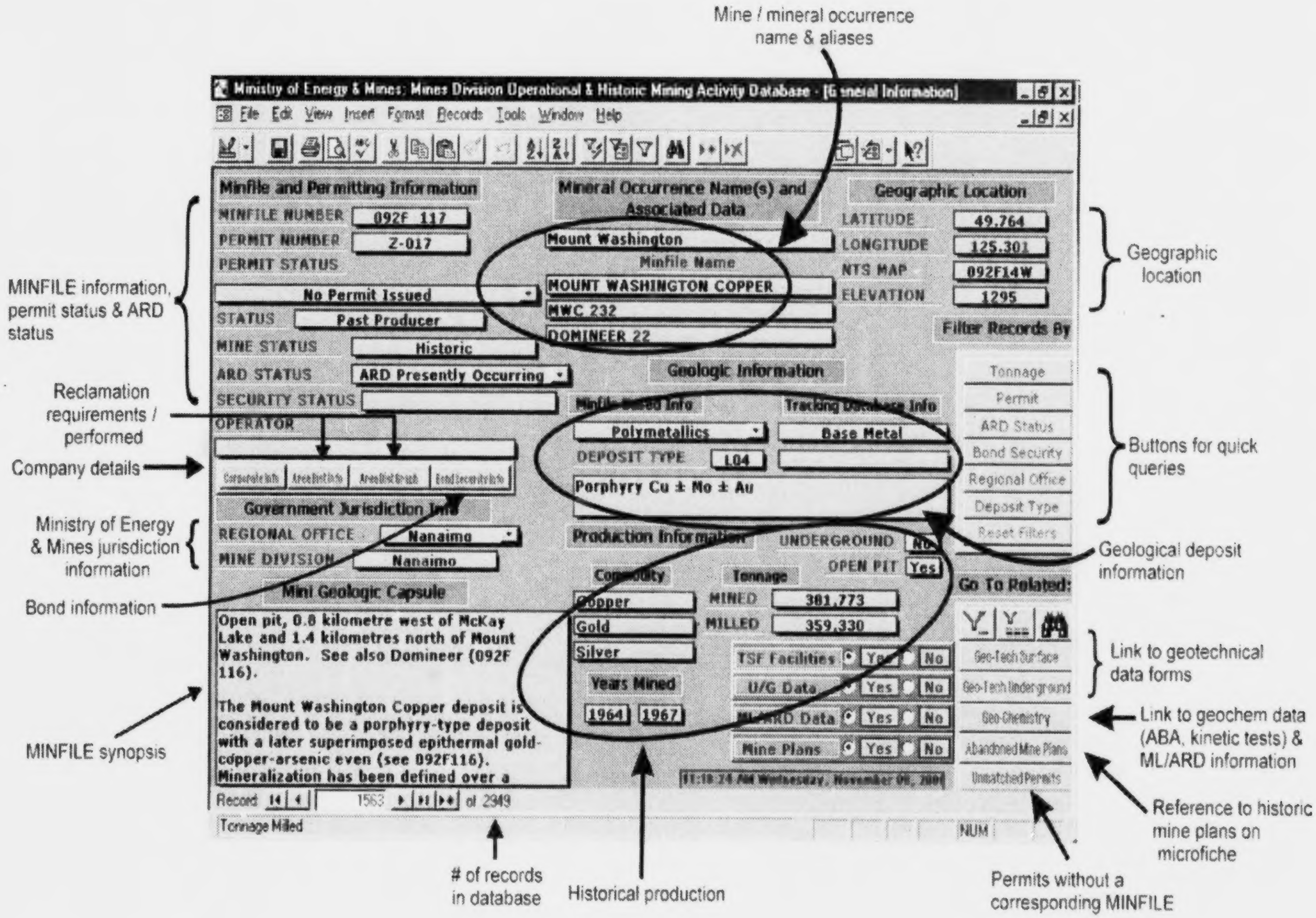
The records in the HMSDB are an extract of the MINFILE database maintained by the B.C. Geological Survey Branch. MINFILE contains geological, location and economic information on over 12,000 metallic, industrial mineral and coal mines, deposits and occurrences in British Columbia. Not all 12,000+ MINFILE records were incorporated into the HMSDB. Records in MINFILE having one or more of the following three criteria qualified to be included:

- status of "past producer";
- contained any documented value for ore mined;
- method of mining is described as either open pit or underground.

Mines that have valid *Mines Act* permits were also included in the database to facilitate compiling technical information for regulatory purposes. These mines, however, are not considered historic sites.

A total of 2,949 MINFILE records were extracted from MINFILE using the above criteria. Specific fields contained in MINFILE were incorporated into the HMSDB that were determined to provide important information for documenting and classifying sites. The fields included were (Figure 1):

- site name and aliases, including mine name if different.
- spatial position (georeferenced latitude/longitude, NTS map sheet, elevation).
- deposit-type information.
- economic information (commodities, years mined, tonnages mined and milled).



Ministry of Energy & Mines; Mines Division Operational & Historic Mining Activity Database - [General Information]

Minfile and Permitting Information

MINFILE NUMBER 092F 117
PERMIT NUMBER Z-017
PERMIT STATUS No Permit Issued
STATUS Past Producer
MINE STATUS Historic
ARD STATUS ARD Presently Occurring
SECURITY STATUS
OPERATOR

Government Jurisdiction Info

REGIONAL OFFICE Nanaimo
MINE DIVISION Nanaimo

Mini Geologic Capsule

Open pit, 0.8 kilometre west of McKay Lake and 1.4 kilometres north of Mount Washington. See also Domineer (092F 116).

The Mount Washington Copper deposit is considered to be a porphyry-type deposit with a later superimposed epithermal gold-copper-arsenic even (see 092F116). Mineralization has been defined over a

Mineral Occurrence Name(s) and Associated Data

Mount Washington
Minfile Name
MOUNT WASHINGTON COPPER
MWC 232
DOMINEER 22

Geologic Information

Minfile Based Info: Polymetallics
Tracking Database Info: Base Metal
DEPOSIT TYPE L04
Porphyry Cu ± Mo ± Au

Production Information

UNDERGROUND No
OPEN PIT Yes

Commodity	Tonnage	
Copper	MINED	301,773
Gold	MILLED	359,330
Silver		

Years Mined 1964 1967

TSF Facilities ● Yes ○ No
U/G Data ● Yes ○ No
ML/ARD Data ● Yes ○ No
Mine Plans ● Yes ○ No

Geographic Location

LATITUDE 49.764
LONGITUDE 125.301
NTS MAP 092F14W
ELEVATION 1295

Record 1563 of 2349

11:18:24 AM Wednesday, November 08, 2001

File Edit View Insert Format Records Tools Window Help
Filter Records By
Tonnage
Permit
ARD Status
Bond Security
Regional Office
Deposit Type
Reset Filters
Go To Related:
Geo-Tech Surface
Geo-Tech Underground
Geo-Chemistry
Abandoned Mine Plans
Unmatched Permits
Tonnage Milled
NUM
Mine / mineral occurrence name & aliases
Geographic location
Buttons for quick queries
Geological deposit information
Link to geotechnical data forms
Link to geochem data (ABA, kinetic tests) & ML/ARD information
Reference to historic mine plans on microfiche
Permits without a corresponding MINFILE
Historical production
# of records in database
MINFILE synopsis
Bond information
Ministry of Energy & Mines jurisdiction information
Company details
Reclamation requirements / performed
MINFILE information, permit status & ARD status

Figure 1. Main form of the Historic Mine Sites Database.

- status (past producer, producer, prospect, developed prospect).
- short geological description of the site, including access and some historical notes.

For more information on MINFILE, consult the MINFILE web page:

Http://www.em.gov.bc.ca/Mining/Geolsurv/MINFILE/.

Matching Mines Act permits to the extracted MINFILE records

All *Mines Act* permits excluding mineral (MX) and coal (CX) exploration permits were matched with the MINFILE records in the HMSDB. *Mines Act* permits and MINFILE records had never been cross-referenced before. This linkage provides an increased ability for database users to query sites and extract information on mines that are currently or formerly permitted. Only selected MX permits that were considered advanced exploration projects were included in the HMSDB.

DEFINITION OF A HISTORIC MINE SITE

Many terms have been used to refer to old mines including abandoned, derelict and orphaned. There is no standard definition for classifying old mines in British Columbia that are dormant, may or may not have an owner, and have not been reclaimed.

The Code defines an abandoned mine as: "a mine for which all permit obligations under this Act have been satisfied and in respect of which the mineral claims have reverted to the government."

This definition makes sense in the context of its application under the *Mines Act*, in that it applies to mines that have been permitted under this legislation. It is not, however, a definition that most people would use to characterize an "abandoned/orphaned" mine site.

Mine sites without a valid *Mines Act* permit are considered, for the purpose of addressing "abandoned/orphaned" sites in British Columbia, "historic" because they are not being regulated by a permit under current mining legislation. Based on this rational, the use of the term "abandoned" has been avoided and "historic" has been adopted to refer to these sites.

The term "mine site" is used as it encompasses all infrastructure related to a mine, including, but not limited to tailings facilities, waste rock dumps, buildings and mills.

A working definition of a historic mine site in British Columbia is:

"a place where mechanical disturbance of the ground or any excavation has been made to produce coal, mineral bearing substances, placer minerals, rock, sand or gravel, or other mined materials, including sites used for processing, concentrating, and waste disposal, and where a Mines Act permit does not exist for the mine site."

For the purpose of defining a historic mine site, there was no attempt to determine current or past ownership through review of subsurface tenure records. The status of MX permits was also not determined for identified sites.

Quantifying Historic Mines Sites in British Columbia

In British Columbia, there are an estimated 1,887 historic mine sites (Figure 2), which range in magnitude from full-scale past producing mines with documentation of hundred of thousands of tonnes of ore mined, to small mines where as little as 1 tonne of ore has been mined, to exploration sites. Table 1 gives the breakdown of historic mine sites according to their status type. Of these 1,887 sites, some may have contemporary *Mines Act* permits approving exploration programs and/or be covered by valid mineral tenures.

The following criteria were selected to best reflect the definition of a historic mine site and, therefore, determine the number of historic mine sites in the province:

TABLE 1
BREAKDOWN OF HISTORIC MINE SITES IN BRITISH COLUMBIA ACCORDING TO THEIR STATUS TYPES

STATUS TYPE	DESCRIPTION	NUMBER
Past Producer	occurrences that are not currently being mined and have recorded production in the past. This does not include bulk samples for testing purposes.	1,761
Developed Prospect	occurrences on which exploration and development have progressed to a stage that allows a reasonable estimate of the amount(s) of one or more of the potentially mineable commodities.	40
Prospect	occurrences documented as containing mineralization which warrants further exploration.	68
Showing	occurrences hosting minor in-situ mineralization.	18
	Total Number of Historic Mine Sites	**1,887**

Each mine sites has a documented value for the amount of ore mined, this amount can be as little as 1 tonne.

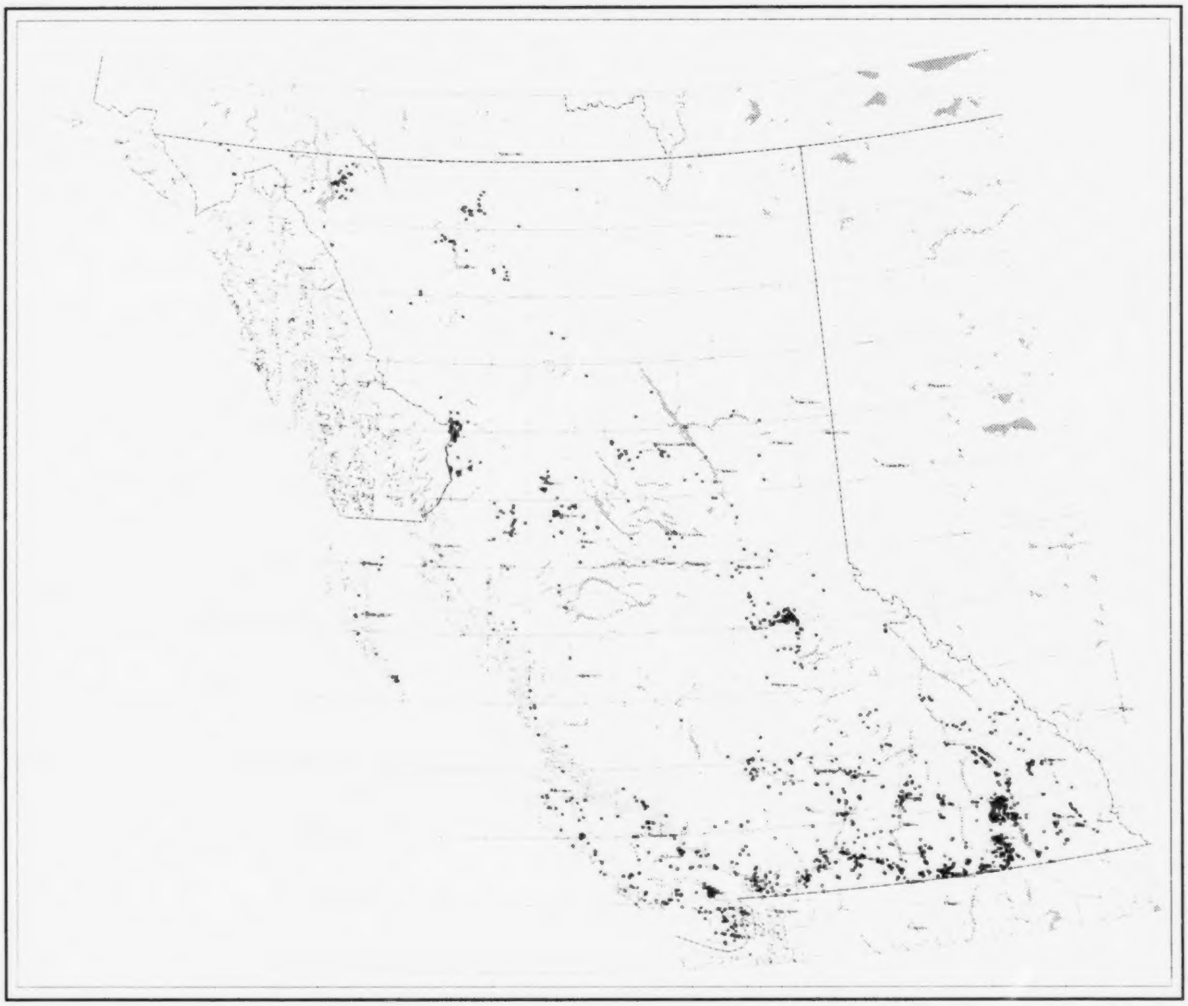


Figure 2. Map of the 1,887 historic mine sites in British Columbia.

a) a status of "past producer"; and

b) without a *Mines Act* permit

OR

a) not a status of past producer (e.g. developed prospect, prospect, showing) but with a documented value of ore mined; and

b) without a *Mines Act* permit.

This total is considered preliminary at this time because the HMSDB does not contain records of some of the exploration sites (showings, prospects and developed prospects) contained in MINFILE. These excluded sites were not incorporated, as they did not meet the criteria selected for constructing the database. It is expected that once a more comprehensive screening of the MINFILE database is performed, a relatively small number of additional sites will be incorporated into the HMDB.

METHODS: HISTORIC MINE SITES PROJECT - 2000/01

SITE SELECTION OF 1,887 HISTORIC MINE SITES

Prioritization of the 1,887 historic sites for site inspections was based on following:

1. Mineral Deposit Type

For the purpose of this study, polymetallic mineral deposits known to have geoenvironmental characteristics, which present a potential for generating acid and/or leaching of metals into the environment, were selected (Table 2). A total of 1,171 sites were determined to have ML/ARD potential. This value excludes coal, placer, industrial mineral and certain metallic deposit types.

2. Degree of Documentation on ML/ARD

Historic mine sites with documented occurrences of ML/ARD, such as Anyox and Mount Washington Copper, were excluded from the field site selection. The intent of this project was to inventory sites where the environmental and health and safety hazards were not documented.

3. Jurisdictional Area

The Mining Division has five Regional Offices, located in Kamloops, Nanaimo, Prince George, Cranbrook and Smithers. As the 2000 fieldwork program aimed to gain a provincial overview of historic mine sites, prioritization of mines sites was not on a provincial scale. Rather, mine sites were ranked and selected according to region.

4. Magnitude of Mining Operation

For each region, the properties were ranked according to the tonnage of ore mined. The rationale was the value of ore mined reflects the scale of the operation and therefore onsite disturbance. The tonnage of ore mined is documented in MINFILE.

The Ministry does not have records of the amount of waste rock generated for each property. Large volumes of waste rock and extensive underground workings may exist, but this can only be verified through site inspections and possibly research, if such documentation exists.

TABLE 2
DEPOSIT TYPES SELECTED FOR THE PRELIMINARY SCREEN OF ML/ARD BY HISTORIC MINES SITES IN BRITISH COLUMBIA

Massive Sulphides
Carbonate hosted Cu-Pb-Zn
Carbonate hosted Pb-Zn
Kootenay Arc Pb-An (sedex)
Sedex Zn-Pb
Massive sulphide Cu-Co
Besshi massive sulphide Zn-Cu-Pb
Cyprus massive sulphide Cu (Zn)
Noranda/Kuroko massive sulphide Cu-Pb-Zn
Skarns
Cu skarn
Zn-Pb skarn
Fe skarn
Au skarn
W skarn
Sn skarn
Lode Gold
Sulphide manto Au
Epithermal Au-Ag: high sulphidation
Epithermal Au-Ag: low sulphidation
Au-Ag-Te veins
Gold-quartz veins
Sub-volcanic shear-hosted gold
Polymetallic Veins & Stockwork
Polymetallic manto Ag-Pb-Zn
Polymetallic veins Ag-Pb-Zn
Cu-Ag quartz veins
Porphyry (alkalic & calc-alkalic)
Subvolcanic Cu-Ag-Au (As-Sb)
Porphyry-related Au
Alkalic porphyry Cu-Au
Porphyry Cu±Mo±
Porphyry Mo
Porphyry Sn
Porphyry W
Climax-type porphyry Mo
Other
Subaqueous hot spring Ag-Au
Hot spring Au-Ag
Tailings

It was recognized while undertaking field inspections that the amount of ore mined and the status of the mine site (past producer, developed prospect, etc.) are not necessarily indicative of the extent of the disturbance on site. Sites such as Jim and Warspite are classified in MINFILE as a showing and prospect respectively. Both Warspite and Jim were inspected in the 2000 field season on the advice of the Regional Inspector. In both cases, the MINFILE status underestimated the degree of surface and underground disturbance; the 'showing' Warspite contains hundreds of metres of underground workings that drain water. The activities undertaken at historic mine sites classified as prospect, developed prospect or showing may have enough surface disturbance to potentially be a concern either environmentally or from a health and safety perspective. Sites such as these will need to be identified through research and inspections as well as canvassing the general public, government field inspectors, and the mining industry, who may have knowledge of the location of sites.

5. Input from Ministry Staff

Ministry Inspectors and in some cases, Regional Geologists provided input into the site selection based on their personal knowledge, accessibility and regional concerns.

6. Time and Budget

Travel time to many of the historic mine sites was lengthy given their remote nature and poor road access. This was a major logistical constraint when selecting sites for inspection.

Properties north of 56 latitude were automatically excluded due to the expense and length of travel required. As seen in Figure 2, relatively few historic mine sites are situated in the northern one-third of British Columbia.

7. Accessibility

Of these factors, accessibility played the largest factor in selection. Access to many of these sites is costly due to their remoteness and the fact that vehicle access is not possible. Many sites require specialized modes of transport, such as helicopter or ATV bikes.

In total, 62 historic mine sites were inspected Figure 3.

FIELDWORK

The Ministry hired a geologist (recent graduate) to undertake field based site inspections in the company of one or more senior ministry staff. Fieldwork involved characterizing each site including the sam-

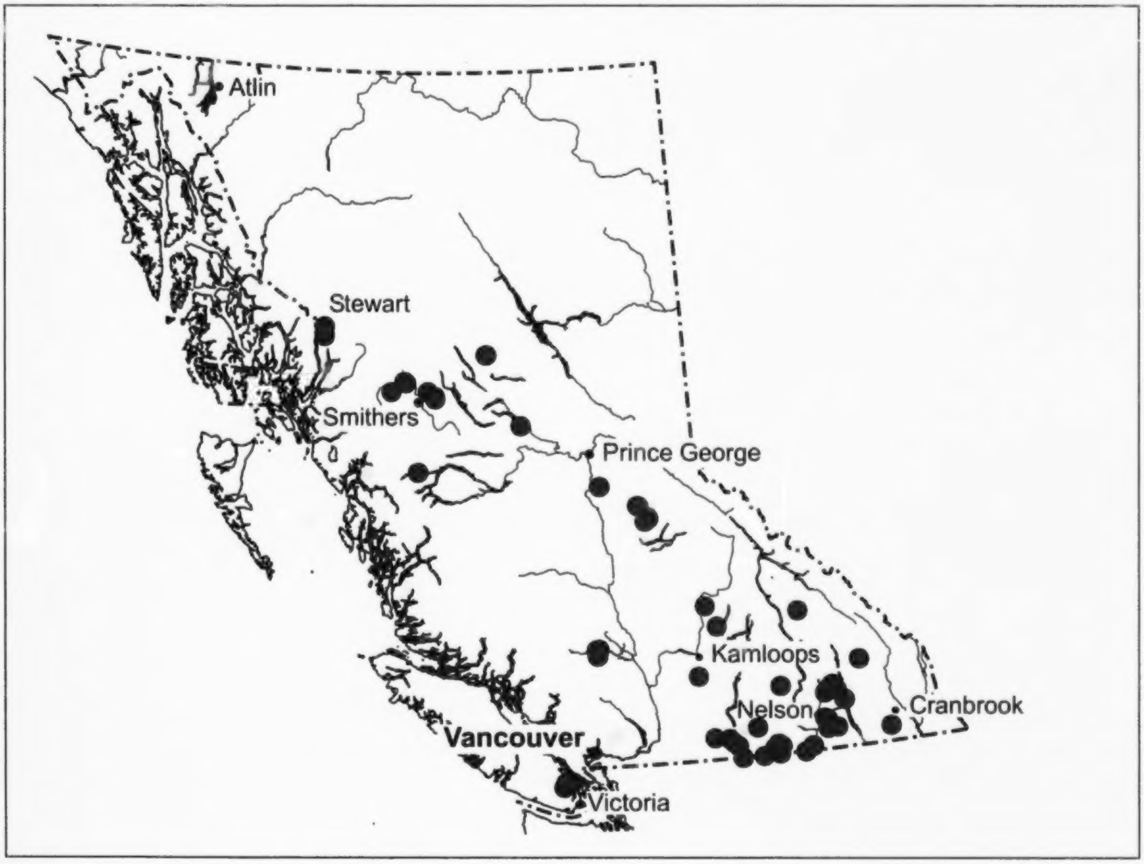


Figure 3. Map of historic mine sites inspected in the 2000 field season. For a more comprehensive map, *see* Appendix C.

pling of mine drainage where water was present. It should be noted that, given the limited budget and time frame of this project, the procedures described were intended to "screen" sites, and were not intended to provide a complete site characterization or constitute a detailed survey.

Onsite, the following information was recorded:

- the extent and distribution of mine workings and their physical stability (portals, waste rock dumps, tailings).
- buildings, mills and other structures.
- general site conditions (surface hydrology, state of vegetation, topography).
- sampled mine drainage.
- documentary photographs.
- field latitude and longitude, if the inspector had a GPS unit.

Locating historic mine sites can be difficult. The extent of mine workings may be unknown, as all of the mine components at a site may not be documented in reports or records or be inaccessible or overgrown with vegetation and not visible. Many sites are adjacent to each other, and may have been connected by roads, trams, rail and underground workings or had their ore processed at one common mill. These sites are difficult to characterize as a single discrete site.

Throughout the course of the fieldwork program, other historic mine workings were encountered. In such a case, the latitude and longitude coordinates of the workings were taken and later matched to a MINFILE property. In some instances, it was not possible to match the workings to MINFILE records and these sites are referred to in the text as 'Unknowns.'

WATER QUALITY PROGRAM

A water sampling program was included as an integral part of the fieldwork component of the project. The purpose of the program is to help prioritize sites where there is an indication of problems with water quality. The analytical results provide a quantitative measure of water quality, which is one piece of information in identifying high risk sites that may require remediation. With the large number of historic mine sites in the province, it is neither efficient nor cost effective to perform comprehensive studies on each individual site. Thus a preliminary survey of sites was initiated in the 2000 field season with the goal of 'flagging' sites, which may require more in-depth studies.

Although the water quality data is a quantitative indicator of ML/ARD, this data (Appendix B) must be interpreted with caution, as results may not be conclusive for the following reasons:

- samples were taken during low flow (not ideal).
- only one or two samples were taken for each site.

Photo 1. Water sampling.

- background or "natural" concentrations were not measured.
- only a simple understanding of the hydrogeology at the sites is known.
- downstream, receiving environment sampling was not undertaken (*i.e.* natural attenuation is unknown).

A potential problem with sampling at a specific time in one location is the possibility for sites with downstream impacts to be overlooked. Although one would expect the water quality to be at its worst during low flow, metal loading and acid can be generated and flushed out in one event such as freshet. However, given the number of historic mine sites in the province and their spatial distribution, a screening-style water sampling program was the most practical approach.

Geochemical Mine Drainage Sampling

Mine drainage was sampled wherever observed and the source was determinable. In total, 45 mine sites were sampled. Sample types include:

- adit drainage.
- tailings ponds.
- waste rock dump seeps and drainage.
- flooded open pits, declines and shafts.

In the field, pH and conductivity were measured using colorpHast Indicator Strips (pH 2-9) and a Hanna DiST WP 3 meter respectively. Observations on the associated odour, precipitates, salts and the state of vegetation were noted.

A suite of samples were taken at each site and sent to a lab for total and dissolved metal concentrations (ICP-AES), SO_4 and pH analyses. For one mine, the Bralorne-Takla, the Hg concentration was also measured. Field duplicates were taken at random for each group of water samples sent to the lab.

TABLE 3
DETECTION LIMITS (DL) FOR METALS IN WATER ANALYZED BY ICP-OES

Element		**Detection Limit (ppm)**
Aluminum	Al	0.2*
Antimony	Sb	0.2*
Arsenic	As	0.2*
Barium	Ba	0.01
Beryllium	Be	0.005
Bismuth	Bi	0.1
Boron	B	0.1
Cadmium	Cd	0.01*
Calcium	Ca	0.05
Chromium	Cr	0.01*
Cobalt	Co	0.01*
Copper	Cu	0.01
Iron	Fe	0.03
Lead	Pb	0.05
Lithium	Li	0.01
Magnesium	Mg	0.1
Manganese	Mn	0.005
Mercury	Hg	0.00005
Molybdenum	Mo	0.03
Nickel	Ni	0.05
Phosphorus	P	0.3
Potassium	K	2
Selenium	Se	0.2*
Silicon	Si	0.05
Silver	Ag	0.01*
Sodium	Na	2
Strontium	Sr	0.005
Thallium	Tl	0.2
Tin	Sn	0.03
Titanium	Ti	0.01
Vanadium	V	0.03
Zinc	Zn	0.005

*Denotes DL below the BC Water Quality Guidelines for aquatic life (MELP, 1997).

As budget constraints only allowed for a standard water quality analyses, metal concentrations were measured in parts per million (ppm). This level was too high to capture the concentrations of select trace metals Table 3, but was selected in order to flag mine sites where metal concentrations exceeded B.C. aquatic life numeric standards.

The water sampling program results and the interpretation are included in the individual Inspection Reports for each mine. Water quality data for all of the mine sites sampled in the 2000 field program can be found in Appendix B.

Only historic mine sites with known MINFILE numbers are listed in this table. See inspection reports on unknown historic mine workings.

In total, 62 historic mine sites were inspected in the 2000 field season (Table 4). Figure 3 depicts the field locations throughout the Province, excluding those workings, which were encountered in the field and not linked to a MINFILE occurrence. For a more detailed map, *see* the map in Appendix C.

TABLE 4
NAMES AND RELATED MINFILE NUMBERS OF THE HISTORIC MINE SITES

MINE SITE NAME	MINFILE #
Banbury	092HSE046
Big Onion	093L 124
Blue Grouse	092C 017
Bralorne Takla	093N 008
Camborne tailings	?082KNW076?* ?082KNW064?*
Canex tailings	082FSW010 082FSW009
Canusa	093H058
Cariboo Gold Quartz	093H 019
Cariboo Hudson	093A 071
Cariboo Thompson	093A 091
Congress	092JNE029
Cork-Province	082FNW094
Cronin	093L 127
Dividend-Lakeview	082ESW001
Dunwell	103P 052
Emerald Glacier	093E 001
Emma	082ESE062
Enterprise	092ISE028
Gopher	082FSW125
Highland	082FNE015
Homestake (Kamad Ag)	082M 025
Island Mountain	093H 006
Jackson	082KSW015
Jane (Snowshoe Gold)	093A027 093A030
Jewel Lake tailings	?082ESE125?*
Jim	093A 037
Kenville	082FSW086
Kootenay Florence	082FNE016
Lenora (Mt. Sicker)	092B 001

MINE SITE NAME	MINFILE #
Lucky Jim	082KSW023
Marmot (Montana)	103P 129
Midas	093A 035
Midway	082GSW021
Motherlode	082ESE034
Native (Lorraine)	093L 129
Oro Denoro	082ESE063
Phoenix	082ESE020
Porter-Idaho	103P 089
Queen Victoria	082FSW082
Quesnel Quartz	093G 015
Red Rose	093M 067
Reno	082FSW036
Richard III (Mt. Sicker)	092B 003
Rocher Deboule	093M 071
Second Relief	082FSW187
Slocan Sovereign	082FNW036
Snowbird	093K 036
Spitzee	082FSW121
Standard (Snowflake)	082ESW091
Sultana	93M 061
Takla Silver (Lustdust)	093N 009
Tremblay (Phoenix) tailings	082ESE262
Twin Lakes	082ESW011
Tyee (Mt. Sicker)	092B 002
Warspite	093H048
Wayside	092JNE030
Windpass-Sweethome	092P 039
Ymir tailings	082FSW067 082FSW068

Only historic mine sites with known MINFILE numbers are listed in this table. See inspection reports on unknown historic mine workings.

*?MINFILE # - indicates that the minesite location may not correspond with the MINFILE #.

SMITHERS REGION

BIG ONION

Property name: BIG ONION
Map number (*see* Appendix C): 1
Mine drainage sample numbers: LB00 - 0101 to 0103
MINFILE number: 093L 124

Date: August 14, 2000
Persons present: Bruce Graff (Mining Division, Smithers), Karl Desjarlais (Highland Helicopters, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny, clear and hot

Regional Office: Smithers
NTS map sheet: 093L15W
Location: south side of Astlais Mountain, 16 kilometres east of Smithers
Access: via helicopter. By road, access from Smithers is available along the all weather Babine Lake gravel road.

Photo 2. Drainage flowing from the Big Onion adits, located behind Bruce.

UTM coordinates: 635544, 6075656 (NAD 27)

Type of deposit: Porphyry Cu ± Mo ± Au
Commodities: Copper, Molybdenum, Gold, Silver
Years mined (open/closed): no record

Mine Workings Inspected:

Two adits, one directly above the other, were inspected.

The adits have collapsed, burying the support timbers. Water was flowing out of the adits and was sampled.

No other mine components, including dumps, were visited or aerially inspected. MINFILE documents the history of activity as exploratory and lists 2 adits as well as trenching and drilling.

Mine Drainage:

The water flowed out of the 2 adits, down an outcrop approximately 3 m high, down a road and into the surrounding forest. The receiving watercourse of the drainage was not determined, but is likely Canyon Creek.

Observations & Analytical Results:

The water flowing from the 2 adits was draining at a net rate of approx. 80 L/min. The field pH = 4.5 and the conductivity = 430 s. The water had no discernible odour. White, green and red precipitates and salts

Photo 3. Downstream of the Big Onion adits

were observed. The Fe precipitates were prolific, depositing a clay-like substrate. The outcrop was covered in moss, the only vegetation within the flow of the water. The water was sampled.

The water quality results are as follows: pH=4.11, $[SO_4]$=215 ppm and hardness=139 ppm.

- The drainage is acidic, as indicated by the field and lab pH values.
- Sulphate is in excess of the water quality guidelines, although it is relatively low given the low value of pH.

Metals in excess of the BC water quality guidelines for aquatic life include Al, Co, Cu, Fe and Mn.

- Al is 3 orders of magnitude greater than the water quality guidelines. The Al species in the drainage are primarily dissolved. The source of the Al is possibly the weathering of the alteration products. Alteration of the rocks is with sericite, kaolinite and chlorite, all of which contain Al.
- Co is 1 order of magnitude greater than the water quality guidelines. Co is primarily of a dissolved form in the drainage.
- Cu is 2 orders of magnitude higher than the water quality guidelines. The Cu is dissolved in the drainage.
- Fe is 2 orders of magnitude higher than the water quality guidelines. Fe is both dissolved and colloidal/particulate in the drainage, although the dissolved fraction is primary. The source is likely the weathering of pyrite, a primary mineral in the deposit.
- Mn is slightly in excess of the water quality guidelines. The Mn in the drainage is dissolved species.

See Appendix B for the geochemical data set.

Additional Comments:

ML/ARD is occurring onsite, although the area of disturbance of the property is small.

References: *See* MINFILE

NATIVE (LORRAINE)

Property name: NATIVE (LORRAINE)
Map number (*see* Appendix C): 2
Mine drainage sample numbers: n/a
MINFILE number: 093L 129

Date: August 14, 2000
Persons present: Bruce Graff (Mining Division, Smithers), Karl Desjarlais (Highland Helicopters, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny, clear and hot

Regional Office: Smithers
NTS map sheet: 093L15W
Location: head of Higgins Creek at ca. 5300 feet
Access: via helicopter.
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Silver, Lead, Zinc, Copper
Years mined (open/closed): no record

Mine Workings Inspected:

The waste rock dump is composed of a series of amalgamated mounds. The particle size ranged from sand to boulder. The dump en masse has no apparent oxidation. It is composed primarily of phyllite and argillite containing ~1-2% disseminated pyrite. Minor galena and chalcopyrite hosted in quartz are present and are slightly oxidized to a red colour. No seeps were observed. The dumps are sparsely vegetated on top with grasses. Wooden debris is mixed in with the dump material.

A collapsed adit with rail tracks is present. Slumped rocks, primarily phyllite and barite, barricade the portal. The wooden structure in front of the portal is collapsed. A trickle of water (~0.5 L/min) was flowing from the adit. The flow rate was so low samples were not taken.

Numerous old wooden buildings are on site, all in a state of decay. Other collapsed wooden structures were noted. Scrap steel also litters the site.

Mine Drainage:

Trickle of drainage from the adit.

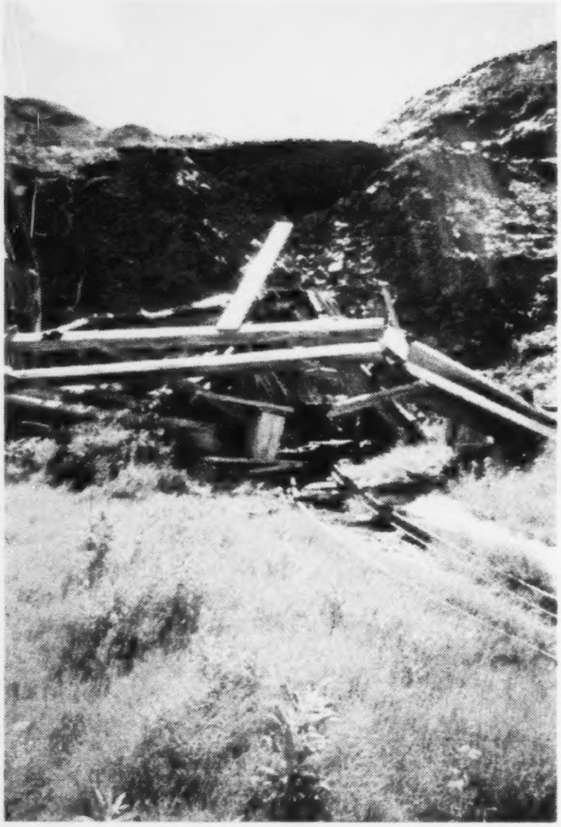


Photo 4. Native (Lorraine) caved portal and waste rock dumps. Drainage flows from the adit.

Observations & Analytical Results:

The water draining from the portal had a field pH = 5.5. Conductivity wasn't measured as the water was too shallow. The water was odourless. No precipitates or salts were visible. Outside the portal was well vegetated with grasses.

Additional Comments:

Small scale site, relatively inaccessible, mainly physical remnants (buildings and debris) to be addressed.

References: *See* MINFILE

CRONIN

Property name: CRONIN
Map number (*see* Appendix C): 3
Mine drainage sample numbers: LB00 - 0301 to 0302; 0305 to 0307
MINFILE number: 093L 127

Date: August 14, 2000
Persons present: Bruce Graff (Mining Division, Smithers), Karl Desjarlais (Highland Helicopters, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny, clear and hot

Regional Office: Smithers
NTS map sheet: 093L15W
Location: on Cronin Creek, on the east side of Mount Cronin, 28 kilometres northeast of Smithers. The mine site is located in Babine Mountain Provincial Park.
Access: via helicopter. Road access from Smithers by Babine Hwy to Km 32, turn west into access road for 10 km to the mine.
UTM coordinates: tailings/mill: 641678, 6088260 (NAD27); elev'n: 3720 ft

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Silver, Lead, Zinc, Gold, Copper, Cadmium
Years mined (open/closed): 1917-1974

Mine Workings Inspected:

At about 6,000 feet, there is a backfilled ventilation shaft. The shaft was used as a raise to transport waste rock and ore to surface. A small wooden hut is adjacent to the shaft.

The waste rock from the shaft is down slope on a steep grade. The dump is about 40 m high and contains rhyolite, quartz vein and argillite. Mineralization present includes 2-3% pyrite, chalcopyrite and pyrrhotite. The waste dump has undergone minor oxidation to a red colour.

The upper adit has been backfilled with talus, making it inaccessible. No surface drainage was observed. The corresponding waste rock dump is down slope on a steep grade. The dump is composed primarily of rhyolite and argillite.

The lower adit (elev. 4720 feet) is backfilled with a small metal pipe to drain the adit water. Some drainage was flowing through the pipe, but most was seeping through the backfill material. The drainage was sampled. The adit is inaccessible.

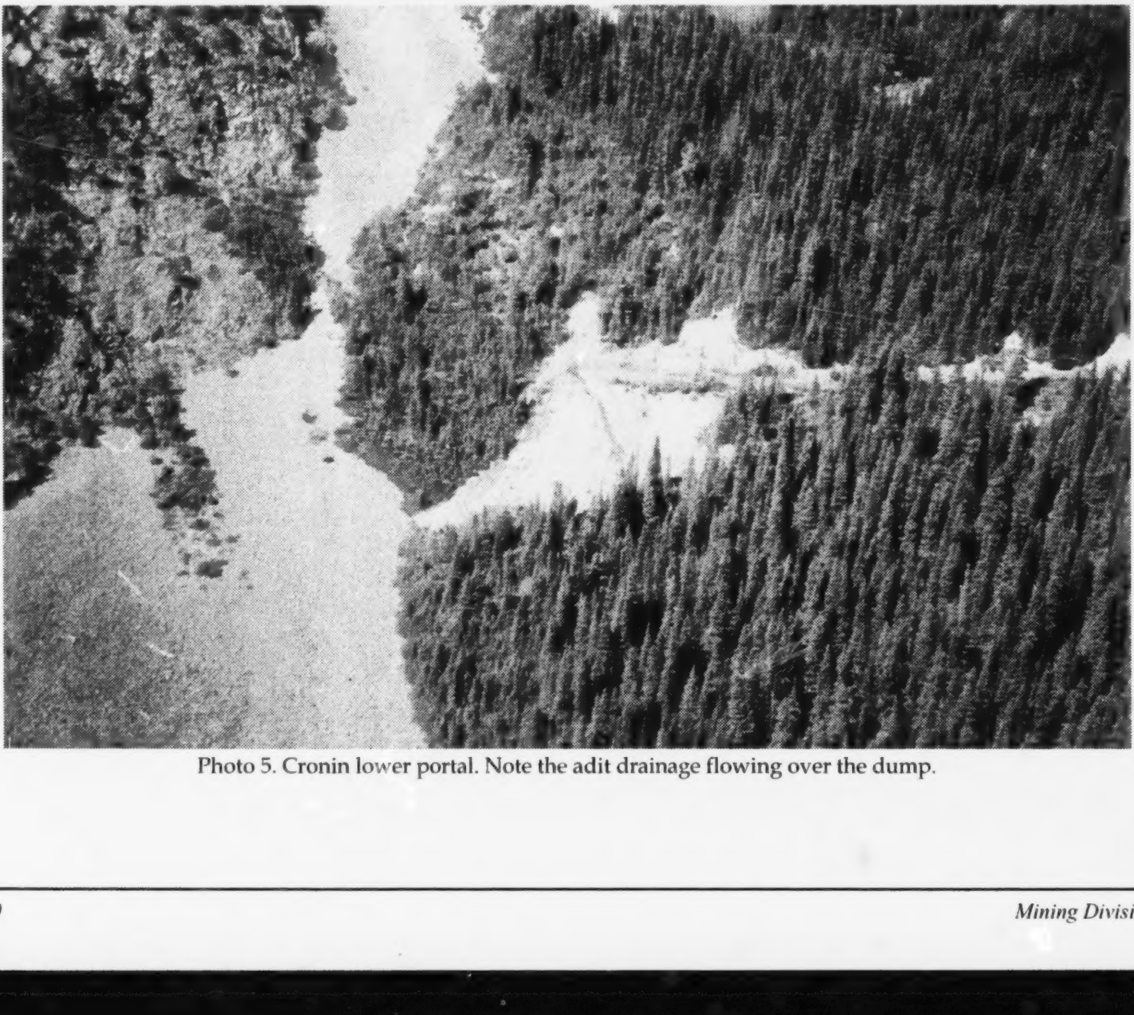


Photo 5. Cronin lower portal. Note the adit drainage flowing over the dump.

Photo 6. Cronin mill and tailings.

The lower waste rock dump is deposited on a steep grade below the lower adit. The composition is primarily rhyolite and argillite with <1% sulphides. The dump height is approximately 15 feet. Wood debris is embedded in the dump.

The tailings and old mill site are situated at an elevation of 3,200 feet. The mill site is upslope and due west of the tailings.

The tailings are situated at the foot of the mill in 3 impoundments alongside Cronin Creek. The tailings are sand sized and appeared unoxidized. There are 2 ponds present, both with horsetail. No seeps were observed. At the time of the inspection the constructed spillways contained white salts and/or thick moss. The area of the moss and salts extended beyond the spillways and into the areas of ephemeral drainage flow. The salts will dissolve and the metals will be transported when they next interact with water. Scrap wood is embedded in the tailings. A small, intact, wooden shack is adjacent to the tailings. Its stability is unknown.

A ditch is situated between the mill and the tailings. Seepage was draining from the foot of the mill site.

At the mill site, barrels and burned debris are present. Two ore piles, a fine and a coarse, are situated at the mill site. The fine ore dump is composed of massive and veinlets of quartz hosted in rhyolite containing <5% disseminated sulphides (chalcopyrite and pyrrhoitite) and <2% secondary malachite. The dump is oxidized to a red-brown colour. Scrap metal and cables, concrete foundations, wooden debris and caved wooden structures litter the mill site.

Water samples were taken from Cronin Creek downstream of the tailings. This is the estimated drainage point of the mine.

Mine Drainage:

The flow from the lower portal drains east down the adjacent waste rock pile where it infiltrates the talus at the base and continues to flow in the subsurface.

At the tailings/mill site, seepage was present at the toe of the mill. The seeping water flowed into the adjacent creek. The seep was not sampled. Ephemeral drainage paths containing salts and moss were present on the tailings surface. Cronin Creek was sampled below the tailings as this was the estimated drainage point for the Cronin mine site.

Observations & Analytical Results:

1. Lower Adit

The flow from the lower adit was ca. 40 L/min. Moss was growing in the vicinity of the water flow. The pH = 5.5 and the conductivity =230 s. The water was odourless. Fe precipitates were observed but no salts were present.

Water quality results from the lower adit are: pH=7.37, $[SO_4]$=24 ppm and hardness = 191 ppm. Mn is the only metal in excess of the BC water quality guidelines for aquatic life.

- Mn is slightly above the water quality guidelines and is in the drainage as a dissolved species.

2. Seep from toe of mill

The seep from the toe of the mill was draining at a rate of approximately 2L/min. The water flowed south into the adjacent Cronin Creek. The pH = 5.5 and conductivity =190 s. No samples were taken.

3. Cronin Creek downstream of tailings

Cronin Creek had a field pH = 5.0 and the conductivity = 50 s.
The water quality results for Cronin Creek are as follows: pH=7.41, $[SO_4]$=4 ppm and hardness = 37 ppm. All metal concentrations are below the BC water quality guidelines.
See Appendix B for the geochemical data set.

Additional Comments:

The Mining Divisionhas been addressing health and safety hazards at this site as Babine Mountain Provincial Park is popular with recreationalists.

References: *See* MINFILE

RED ROSE

Property name: RED ROSE
Map number (*see* Appendix C): 4
Mine drainage sample numbers: LB00 - 0402 to 0404
MINFILE number: 093M 067

Date: August 15, 2000
Persons present: Bruce Graff, Esther Burchett (Mining Division, Smithers), Karl Desjarlais (Highland Helicopters, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast and cool

Regional Office: Smithers
NTS map sheet: 093M04E
Location: Red Rose is in the Rocher Deboule Mountains on the ridge (~6,500 ft) between Armagosa and Red Rose Creeks. The mill camp (~ 4,000 ft) is located on Red Rose Creek.
Access: by helicopter.
UTM coordinates: tailings: 587816, 6110240 (NAD 27)

Type of deposit: W veins
Commodities: Tungsten, Copper, Gold, Silver, Molybdenum, Uranium
Years mined (open/closed): 1942-1954

Mine Workings Inspected:

The site consists of 2 camps: the upper mine camp and the lower mill camp.

1. Upper mine camp

The lower portal, known as the 800 level portal, is collapsed. The adit is open but rotting timbers and slumping talus were barring access. Blue drainage was flowing from the adit. The drainage was sampled.

Downslope of the 800 level portal is a waste rock dump. The drainage infiltrated the dump.

The upper portal, known as the 600 level, is closed by a wooden door. No water was flowing from this adit. The 600 level portal served as the main haulage portal. The ore was transported by aerial tramway from the portal to the lower mill camp.

Two portals, the 100 and 200 level portal, located above the 600 level were not inspected.

Numerous decaying wooden buildings are on site, including the former bunkhouses, assay lab, core shack, maintenance buildings and tram structures. No tram machinery was observed. Core, scrap metal and garbage were littered around the camp.

2. Lower mill camp

The lower mill camp is situated in the Red Rose Creek valley, south of the upper camp. The lower camp is comprised of the mill foundation, old camp buildings, and the tailings pond. Only the tailings facilities were inspected on the ground.

The tailings (elev. 3800 ft) extend along the length of the valley from the mill to the tailings impoundment, approximately 400 m down slope. The area is about 400 m by 100 m. Red Rose Creek flows through the length of the tailings. Red Rose Creek has undoubtedly entrained the tailings, washing them downstream. Mature trees, lichen, moss and shrubs are growing throughout the valley, in the tailings. The tailings impoundment is approximately 65 m by 50 m by 0.5 m. Sparse malachite was mineralizing from the coarse grained tailings. No seeps were observed. Lichen and moss were sparsely growing from the tailings contained in the impoundment.

Mine Drainage:

The drainage from the 800 level portal infiltrates the adjacent waste rock dump. The drainage was not observed downstream of the dump. The receiving environment is Red Rose Creek, which eventually flows into the Kitseguela River.

Observations & Analytical Results:

1. 800 level portal

Turbid, odourless, blue water was flowing out of the 800 level portal at approximately 30 L/min. The field pH = 5.0, conductivity =640 s and the temperature ~5C. Heavy malachite precipitation was evident in the drainage ponds outside of the portal. Deposition of the malachite was up to 15 cm deep. No vegetation was present in the alpine.

Water quality results are as follows: pH=7.11, $[SO_4]$=405 ppm, hardness=430 ppm.

Elevated metals in excess of the BC water quality guidelines for aquatic life include Al, Co, Cu and Fe.

- Al is 1 order of magnitude higher than the water quality guidelines. The species of Al is colloidal/particulate.
- Co is 1 order of magnitude greater than the water quality guidelines. Co is dissolved in the drainage.
- Cu is 2 orders of magnitude above the water quality guidelines. Cu is both dissolved and colloidal/particulate. The particulate fraction is high as malachite was unavoidably sampled with the drainage.
- Dissolved Fe is below the water quality guidelines but the total concentration (dissolved + colloidal/particulate species) is of the same magnitude but above the threshold concentration. No precipitates were observed.

Photo 7. Upper camp of the Red Rose mine. The site is a favoured backcountry destination.

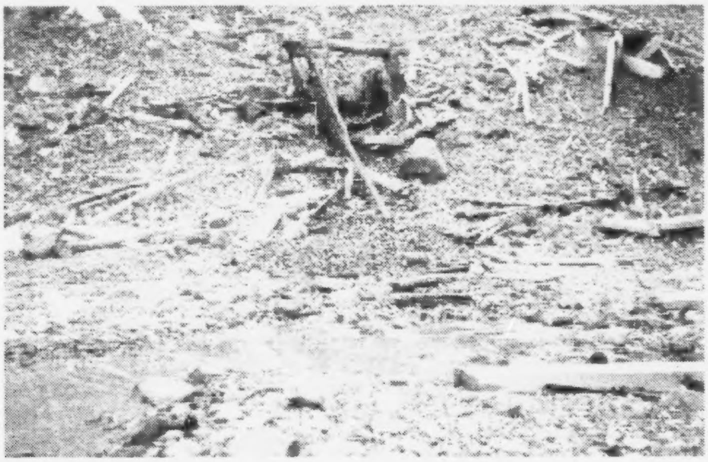


Photo 8. Drainage with malachite precipitate flowing from the 800 level portal, Red Rose mine.

See Appendix B for the geochemical data set.

Additional Comments:

Closed due to fire, leaving 20,000 tonnes of broken and blocked out ore in stopes.

Dilution, coupled with the remoteness and altitude of this site puts this property in a lower risk category in terms of environmental impacts.

This site is considered a destination area by backcountry skiers and hikers. Locals expressed their interest keeping the historic buildings and infrastructure for their 'tourism' value.

References: *See* MINFILE

Sutherland Brown, A., 1960. Geology of Rocher Deboule Range. British Columbia Department of Mines and Petroleum Resources, Bulletin No. 43, 78 pages.

ROCHER DEBOULE

Property name: ROCHER DEBOULE
Map number (*see* Appendix C): 5
Mine drainage sample numbers: LB00 - 0501 to 0503
MINFILE number: 093M 071

Date: August 15, 2000
Persons present: Bruce Graff, Esther Burchett (Mining Division, Smithers), Karl Desjarlais (Highland Helicopters, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast and cool

Regional Office: Smithers
NTS map sheet: 093M04E
Location: northeastern portion of Rocher Deboule Mountain, 11 kilometres south of Hazelton
Access:. by helicopter
UTM coordinates: mill: 586715, 6112944

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au.; W veins; Subvolcanic Cu-Ag-Au (As-Sb)
Commodities: Copper, Silver, Gold, Tungsten, Zinc, Lead, Uranium, Molybdenum, Cobalt

Years mined (open/closed): 1915-1929

Mine Workings Inspected:

The portals were aerially inspected, as they are located on the steep face of Rocher Deboule Mountain. About nine adits in total were observed. Of those, three were draining water. The rocks surrounding the portals are oxidized; iron staining and malachite were observed. Train tracks still run along the mountain although they are rusted and bent. The wooden trestle is collapsing, cascading wooden debris down the slope. The tram head and line are still present. A massive waste rock pile is situated below the tramline, running down the mountain slope from the train trestle.

The mill site is located in the valley at an elevation of 4080 ft. The ore was brought to the mill site via the tram. The mill site is in a state of disrepair with numerous decaying, collapsed buildings that are potential health and safety risks. The wooden structure, possibly a load out station is still erect. Fine and coarse ore bins are on site but no ore piles were found. Wood debris, core and core boxes, concrete foundations and scrap metal (cars frames, bikes) noted on site.

End dumped waste rock (diorite and quartz) is situated at the head of the mill site. The dump is located on a hill slope with approximate dimensions of 40 m by 20 m. Observable mineralization is sparse to non-existent. Oxidation and secondary malachite are sparse.

No tailings are present. They were most likely flushed into Juniper Creek, east of the mill. Water was sampled from Juniper Creek.

Photo 9. Rocher Deboule mill site.

Mine Drainage:

Surface drainage observed was from 3 inaccessible portals on the face of Rocher Deboule Mountain.

The tailings were likely flushed down Juniper Creek, a tributary of the Kitsuegula River.

Observations & Analytical Results:

Juniper creek had a field pH = 5.0, conductivity = 50 s.

The geochemical results of the stream water are as follows: pH=7.5, [SO_4]=19 ppm and H=27 ppm. No metals are elevated above the BC Water Quality guidelines for aquatic life.

See Appendix B for the geochemical data set.

Additional Comments:

Juniper Creek is also the receiving creek for the Red Rose mine (**093M 067**) and another past producer, Highland Boy (**093M 070**). Highland Boy is located northeast of Rocher Deboule mine, at the headwaters of Juniper Creek. It was a small, short-lived property having 68 tonnes of ore extracted in 1917.

References: *See* MINFILE

Sutherland Brown, A., 1960. Geology of Rocher Deboule Range. British Columbia Department of Mines and Petroleum Resources, Bulletin No. 43, 78 pages.

SULTANA

Property name: SULTANA
Map number (*see* Appendix C): 6
Mine drainage sample numbers: LB00-0601 to 0603
MINFILE number: 093M 061

Date: August 15, 2000
Persons present: Bruce Graff, Esther Burchett (Mining Division, Smithers), Karl Desjarlais (Highland Helicopters, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast and cool

Regional Office: Smithers
NTS map sheet: 093M04E
Location: southeast side of the Rocher Deboule Range, in the alpine, near the headwaters of Boulder Creek, 16 kilometres south of New Hazleton.
Access: by helicopter. Access road appears overgrown.
UTM coordinates: 593259, 6106746; elevation: 4980 ft

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au; Porphyry Cu ± Mo ± Au
Commodities: Silver, Copper, Molybdenum, Gold
Years mined (open/closed): no record

Mine Workings Inspected:

The site is comprised of one exploration adit, a waste rock dump and the remains of an exploration camp.

The waste rock is pervasively oxidized to a very distinct orange-red colour. Crystals (1cm) of pyrite and chalcopyrite are prolific in the dump, comprising about 5-10% of the rock. Dump lithologies include granodiorite as well as quartz veins, both of which contain sulphide minerals. MINFILE states there is molybdenite and tetrahedrite mineralization, which were not observed. The waste rock is strewn over an area of approximately 600 m^2. One dump of waste rock, about 10 m high by 20 m x15 m is centred in the waste rock area. The rocks were very reactive and sulphide rich. No vegetation was present.

The portal was capped by snow. Red water was flowing from the adit. The drainage was sampled.

Remnants of the exploration camp (E594251, N6106792) adjacent to the workings include numerous empty barrels, scrap steel, collapsed wooden structures and a dilapidated hut.

Mine Drainage:

The drainage from the adit pooled on the oxidized waste rock, before draining into the receiving environment. The termination of drainage was not determined, although the mine is within the Boulder Creek watershed. Boulder Creek is a tributary of the Bulkley River. The flow from the adit was higher earlier in the season as indicated by the numerous and small, ephemeral channels observed in the waste rock area.

Observations & Analytical Results:

Drainage from the adit was flowing at an approximate rate of 30 L/min. The field pH = 5.0, conductiv-

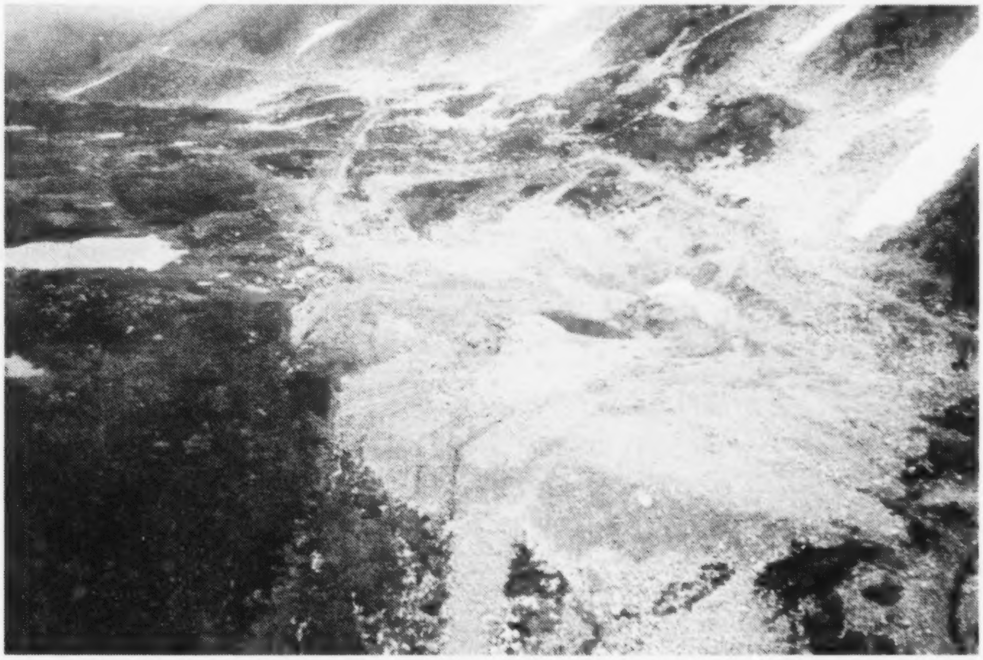


Photo 10. Area of disturbance at the Sultana mine site. The portal is located under the patch of snow. Note the drainage pooling and draining from the portal (dark red).

ity = 50 s, the smell of the water was slightly sulphurous and iron precipitate was concentrated heavily in the water, explaining the red, turbid nature of the drainage. The water from the adit flowed over the waste rock area and off site. Water samples were taken outside the portal.

Geochemical results from the water sampling are: pH=3.54, [SO_4]=78 ppm and hardness =24 ppm.

- drainage is acidic as indicated by the lab pH. The field pH = 5.0, which is less acidic than the lab results. The sulphate concentration is considerably low, given the acidity of the drainage. The sulphate may be chemically combining with other cations in the drainage.
- the buffering capacity of the system is low, as indicated by the hardness.

Fe is the only metal in excess of the water quality guidelines for aquatic life. Cu and Zn are also above the guidelines but their results are suspect; the dissolved concentrations are greater than the total for both cations.

- Dissolved iron is below the water quality guidelines while colloidal/particulate Fe is 1 order of magnitude higher. The drainage was heavy in iron precipitate, thereby increasing the Fe concentration of the water.

See Appendix B for the geochemical data set.

Additional Comments:

MINFILE property status is listed as "showing." This status does not reflect the extent of disturbance on site.

GeochemicaResults of the adit drainage indicate ML/ARD issues on site. In addition, the waste rock contains visible sulphides and is strongly oxidized. The mine site is remote and the disturbance is small scale (approximately 600 m^2). The drainage was not sampled downstream of its chemical interactions with the oxidized waste rock.

REFERENCES: *See* MINFILE

Sutherland Brown, A., 1960. Geology of Rocher Deboule Range. British Columbia Department of Mines and Petroleum Resources, Bulletin No. 43, 78 pages.

EMERALD GLACIER

Property name: EMERALD GLACIER
Map number (*see* Appendix C): 7
Mine drainage sample numbers: LB00-0701, 0703, 0704
MINFILE number: 093E 001

Date: August 16, 2000
Persons present: Bruce Graff (Mining Division, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: cool and overcast

Regional Office: Smithers
NTS map sheet: 093E11W
Location: south side of Mount Sweeney in the Sibola Range about 6 miles from Tahtsa River. The workings are centred on the Crown Granted Lots 2760-2763.
Access: Sweeney Lake road, accessible from Houston
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Zinc, Silver, Lead, Copper, Gold, Cadmium, Molybdenum
Years mined (open/closed): 1951-53; 1966-68

Mine Workings Inspected:

The site consists of 2 camps: the upper mine camp and the lower mill camp.

1. Upper mine camp

The workings are accessible by a road east of Rhine Creek. The access road is passable; Telus uses this road to access their repeater.

Four portals are on site although only two are open (B. Graff, aerial inspection, 1999). The 6000′ and 6400′ adits were inspected at the mine site.

The 6000′ adit is open and accessible with good ventilation, as indicated by the strong draft. The portal is collared with timbers. Snow was still present in the mouth of the adit. Tracks run out of the portal and on to the crest of the adjacent waste rock dump. No drainage was present.

End dumping formed the 6000′ waste rock dump. Few visible sulphides are present in the sandstone and dacite. No visible salts or oxidation are present. Wood debris and metal are scattered on and imbedded in the dump.

The 6400′ portal is accessible with good ventilation, as indicated by the draft from the adit. The portal is collared with timbers. Drainage was flowing from the adit, which was sampled. Tracks lead out of the adit on to the adjacent dump.

A waste rock dump is situated below the 6400′ portal. Tracks lead onto the crest of the dump; this waste rock was end dumped down the mountain slope. The waste rock is oxidized in patches to a red colour. The dump contains very few observable sulphides. No salts were present. A wooden structure, possibly a trestle, is collapsed on the dump.

A dilapidated wooden shed as well as lots of wooden and metal debris, is also on site.

The miner's camp is situated at about 5,100 feet and consists of three or so collapsed buildings that were likely bunkhouses.

Above the camp, a collapsed portal was noted. This was possibly the 5400′ level portal.

2. Lower mill camp

The access road to the mill is to the east of the upper camp access road. There are snowmobile/ski club cabins on this road.

The tailings are located at the foot of the mountain, southeast of the mine. The tailings were deposited in 2 impoundments.

The northern tailings impoundment is about 100 m by 20 m by 0.1 m. The periphery of the tailings is vegetated with immature trees and red lichen. No seeps, signs of oxidation or salts were observed.

The approximate distribution of the lower tailings is 70 m by 15 m by 0.5 m. An unnamed creek runs along the eastern edge. In the main area of the tailings, vegetation is scarce although the peripheral areas are heavily vegetated with grasses and immature trees. The tailings are dammed by a collapsing wooden picket fence. The tailings are silt size with no distinguishable minerals. The oxidation colour is red-brown, present on the surface and in the subsurface to an approximate depth of 40 cm. The saturation of the tailings increased with depth although no observable seeps were present.

The wooden mill buildings, including the fine and coarse grain ore bins and load out station, are standing, although the buildings are generally in a state of disrepair. No equipment remains on site. A small pile of ore is present. Remains of Zn-concentrate are in the mill. Wooden debris litters the site.

Mine Drainage:

The drainage from the 6400′ adit flowed from the adit and infiltrated the ground. The receiving water body is the Rhine Creek, a tributary of Tahtsa Reach.

Observations & Analytical Results:

1. 6400′ adit

The flow from the 6400′ adit was approximately 5 L/min, the field pH = 5.0 and conductivity = 150 s.

Photo 11. Emerald Glacier tailings. The workings are located on Mount Sweeney, located in the background.

No precipitates, salts or vegetation were present. The water was odourless.

Geochemical results from the drainage sampling are: pH=6.73, [SO_4]=30 ppm and hardness=88 ppm. The acid generating and buffering capacity of this system appear to be low.

The only metal in excess of the BC water quality guidelines for aquatic life is Zn (primarily dissolved).

- Zn is 3 orders of magnitude higher than the water quality guidelines. The Zn species in the drainage are dissolved. (diss=4.19 ppm, tot=4.22 ppm, WQ guideline=0.033).
- Fe and Pb concentrations are both approaching the water quality guideline threshold concentrations. The concentration of these metals may fluctuate seasonally. Both metal species are colloidal/particulate.

See Appendix B for the geochemical data set.

Additional Comments:

The site is small and remote.

References: *See* MINFILE

Geological Survey of Canada, Memoir 299, p 84-87.

MARMOT (Montana)

Property Name: MARMOT [MONTANA (L.4974)]
Map number (*see* Appendix C): 8
Mine drainage sample numbers: LB00-0801, 0803, 0804
MINFILE number: 103P 129

Date: August 19, 2000
Persons present: Bruce Graff (Mining Division, Smithers) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast and raining

Regional Office: Smithers
NTS map sheet: 103P13W
Location: at approximately 5,000 feet on the north side of the Marmot River, 9 kilometres east of the Portland Canal and 11 kilometres southeast of Stewart.
Access:. Helicopter only.
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Silver, Zinc, Lead, Gold, Copper
Years mined (open/closed): 1913, 1915, 1930

Mine Workings Inspected:

There are 3 portals documented on the Marmot property. Only 2 were located.

Portal 2 is the middle portal and was observed aerially. No drainage or oxidation was observed from the air.

Portal 1, located adjacent to the camp, is open and accessible. The portal is timbered. The water flowing from the adit was sampled. Water was dripping from the roof of the adit. Iron pipes were running along the ground and the ceiling of the adit. Scrap pipes and PVC tubing lay in the mouth of the adit. A rusted compressor is located outside the adit.

No waste rock dump observed on site.

The camp, comprising 4 bunkhouses, is still standing and habitable. Gear and furniture are inside the buildings.

Mine Drainage:

The drainage flowing from portal 1 infiltrated the talus.

Observations & Analytical Results:

The drainage flowing from portal 1 was draining at about 20L/min. The field pH = 5.0 and conductivity = 60 s. The water had no odour. Grasses were growing alongside the drainage

The geochemical water results are: pH=7.2, [SO_4]=16 ppm and H=44 ppm.

All metal concentrations were below the BC water quality guidelines for aquatic life.

See Appendix B for the geochemical data set.

Additional Comments:

This site is low risk in terms of environmental liabilities.

References: *See* MINFILE

Geological Survey of Canada, Memoir 159, p. 66-67.

Photo 12. Marmot exploration camp.

PORTER IDAHO

Property name: PORTER-IDAHO
Map number (*see* Appendix C): 9
Mine drainage sample numbers: LB00-0901, 0903, 0904
MINFILE number: 103P 089
Date: August 19, 2000
Persons present: Bruce Graff (Mining Division, Smithers) and L. Barazzuol (Mining Division, Victoria)
Weather: rainy, windy and at some points foggy. Some snow on ground.

Regional Office: Smithers
NTS map sheet: 103P13W
Location: the south slope of Mount Rainey, 5.5 kilometres southeast of Stewart at about 4,200 to 6,000 feet.
Access: by helicopter

UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au; Subaqueous hot spring Ag-Au
Commodities: Silver, Lead, Zinc, Gold, Copper
Years mined (open/closed): intermittently, 1922-50; 1981 (22 tonnes - exploration?)

Mine Workings Inspected:

The site was inspected aerially with the exception of the 4700′ portal waste rock dump. Poor visibility forced us to land at the 4700′ portal, prompting the inspection.

1. Ground Inspection

The 4700′ portal is open and accessible. Rail tracks are coming from the timbered portal. The drainage flowing from the adit was sampled. Garbage was lying in the portal. Adjacent to the portal are numerous collapsed wooden buildings, barrels and rusting metal pipes.

Tracks run out of the adit to a waste rock dump. The dump cascades down the hillside for about 500 m below the adit. The waste rock dump is slightly oxidized. Some vegetation is growing on the dump. Minor galena is hosted in quartz and andesite.

2. Aerial Inspection

The 4250′ portal was located - no water flow.

5400′ portal backfilled - no observable water drainage.

Drainage was flowing from an undetermined portal - flow ca. 40-50 L/min. The portal is situated under debris.

The mill buildings on site are in a state of decay.

Numerous wooden buildings and structures are collapsing or have collapsed. Wooden debris, garbage, scrap steel, pipes and barrels are strewn over the site. The remains of a concrete foundation, water tank and

Photo 13. **Porter-Idaho portal (unknown level). The drainage flowing from the adit was sampled.**

stone building are also present. The tram towers are still standing.

Mine Drainage:

The water flowed from the adit to the SE, and then to the NE around the periphery of the waste rock pile. The mine is within the Kate Ryan Creek watershed, which flows into the Marmot River. The confluence of the Kate Ryan Creek and Marmot River is proximal to the Portland Canal.

Observations & Analytical Results:

The drainage from the 4700′ portal flowed at an approximate rate of 40 L/min. The water temperature was approximately 4 C, pH = 5.0 and conductivity = 90 s. No salts were present, only iron precipitate. This absence of salts may be attributable to the recent rainfall. The drainage was odourless. Water was sampled inside the portal.

Water quality results for the 4700′ portal are as follows: pH=7.3, $[SO_4]$=15 ppm and hardness=63 ppm. Zn is the only metal in excess of the BC water quality guidelines.

- Zn is of the same order of magnitude as the water quality guidelines. The Zn in the drainage is dissolved.

See Appendix B for the geochemical data set.

References: *See* MINFILE

Geological Survey of Canada, Memoir 175, p. 138-141.

DUNWELL

Property name: DUNWELL
Map number (*see* Appendix C): 10
Mine drainage sample numbers: LB00-1002 to1004
MINFILE number: 103P 052

Date: August 19, 2000
Persons present: Bruce Graff (Mining Division, Smithers) and L. Barazzuol (Mining Division, Victoria)
Weather: overcast, raining lightly

Regional Office: Smithers
NTS map sheet: 103P13W
Location: 7.5 kilometres northeast of Stewart on the north side of Glacier Creek, a tributary of Bear River.
Access: by helicopter
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Zinc, Gold, Silver, Lead
Years mined (open/closed): 1926-37

Mine Workings Inspected:

Only the 1200′ portal and associated waste rock dump was inspected. The mill site was not located but was reported to exist.

The 1200′ portal is open and accessible. A strong breeze was blowing from the timbered adit. Rail tracks are intact in the adit. The turbid, red drainage flowing from the adit was sampled.

The waste rock dump is an amalgamation of 3 dumps deposited in an arcuate shape on a hill slope. The dump was approximately 15m high and 40 m long. Sparse disseminated pyrite and galena is hosted in quartz and argillite. The dump is heavily oxidized. Water was seeping from the toe of the southern part of the dump, near to where the 1200′ portal drainage was flowing over the dump. The dump wasn't saturated enough to fill a test pit. Rusted tanks, pipes, rubber hoses, wood and other debris are scattered about and embedded in the dump.

Mine Drainage:

Water flowed from the adit, southeast along a road and down the southern end of the waste rock dump. From the foot of the waste rock dump, the water flowed overland into a marsh. Ephemeral flow paths near the portal indicated the flow of drainage was higher earlier in the season. The receiving water body is Dunwell Creek, which merges with Glacier Creek. Downstream of the property, red drainage flowing through the forest was observed from the air.

Observations & Analytical Results:

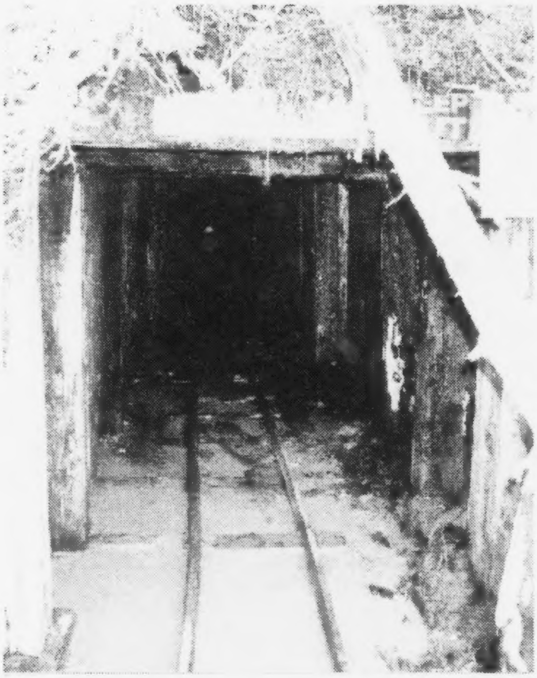


Photo 14. Dunwell 1200′ portal. The drainage was sampled.

The drainage from the 1200′ portal was turbid from the heavy iron precipitation. Sedimentation of the precipitates was up to 10 cm in places. The flow from the adit was about 20 L/min. Zinc precipitates were also present but were less prolific than the iron precipitates. The water was sampled at the foot of the waste rock dump. The pH = 5.0 and conductivity = 380 s. The water was organic smelling. No vegetation was present proximal to the adit. At the foot of the waste rock dump shrubs and lichen were present.

The water quality results are as follows: pH=6.9, $[SO_4]$=118 ppm and hardness =154 ppm. The drainage is neutral and the acid generating and buffering capacities of the system are low. Metals with reliable data, in excess of the BC water quality guidelines include Cd and Mn.

- Cd is dissolved in the drainage and is 3 orders of magnitude higher than the water quality guidelines.
- Mn is dissolved in the drainage and is of the same magnitude as the water quality guidelines.

Duplicates of the dissolved metal content were not consistent for all metals. Metals with inconsistencies in data that are above the BC water quality guidelines include Al, Cu, Fe, and Zn. The data are not reliable enough to make conclusions.
See Appendix B for the geochemical data set.

Additional Comments:

Receiving water body is the Bear River, which flows through the town of Stewart.

References: *See* MINFILE

WAYSIDE

Property name: WAYSIDE
Map number (*see* Appendix C): 11
Mine drainage sample numbers: LB00-1201 to 1203
MINFILE number: 092JNE030

Date: September 5, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast and warm

Regional Office: Kamloops
NTS map sheet: 092J15W
Location: 1.5 kilometres north of Gold Bridge, abutting the Gold Bridge Highway. The lower workings are on the west shore of Carpenter Lake.
Access: *see* location
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities: Gold, Silver, Copper, Lead, Zinc, Antimony
Years mined (open/closed): 1915-1937

Mine Workings Inspected:

The infrastructure located and inspected includes the No. 5 portal, 2 waste rock dumps, mill foundations and tailings.

The No. 5 adit is the lowest, most southerly adit of the Wayside workings The adit was inaccessible as it was gated and locked. The drainage flowing from the adit was sampled.

Situated south of the adit and toward Carpenter Lake is the upper waste rock dump. The waste rock is lithified diorite, argillite and greenstone. The pile is sparsely oxidized. The volume of this dump is in the order of ~2500 m^3. The face of the dump is naturally revegetated with grasses and some shrubs. The drainage from the No. 5 adit infiltrates the dump.

South of the upper waste rock dump are the remaining foundations of the mill. Some scrap metal is on site.

South of the mill, the sand-sized tailings have been deposited on the shore and in Carpenter Lake. The tailings are subaerially exposed 2m above the lake level. The submerged tailings have eroded into benches. The tailings above the water level are unsaturated. The tailings are oxidized on surface and in the subsurface to a brown-red colour. The depth of the oxidation is unknown. Grass is growing in patches on the tailings. The volume of the tailings is in the order of 10,000 m^3.

Deposited in a mound on top of the tailings is the lower waste rock dump. The size of the material in the

Photo 15. Wayside adit.

lower waste rock dump ranges from fines to boulders. The fines were sampled. Oxidation of the dump is pervasive and a red-brown colour. Lithologies within the dump include quartz, diorite, argillite and greenstone. A few immature trees growing from the dump and grasses are present around the base. The southern end of the dump toes into the river. The volume of the dump is in the order of ~2500 m^3.

Mine Drainage:

The drainage from the No. 5 adit infiltrates the upper waste rock pile. The workings are located on the shore of Carpenter Lake, the receiving watercourse.

Observations & Analytical Results:

The water flow from the No. 5 adit was sparse, about 1 L/min. The field pH = 7.5 and the conductivity = 520 s. Green moss was growing within the drainage. There was no visible evidence of secondary minerals, precipitates or salts. The drainage was odourless. Samples were taken.

Water quality results are: pH = 8.49, [SO_4] = 94 ppm and hardness = 194 ppm. Metal concentrations above the water quality guidelines for aquatic life are As and Fe.

- As is in excess of the water quality guidelines by 1 order of magnitude. There is no dissolved fraction of As in the drainage.
- Fe is only slightly above the water quality guidelines. The Fe in the drainage is purely colloidal/particulate, although Fe precipitation was not observed in the drainage.

See Appendix B for the geochemical data set.

Additional Comments:

Alkaline metal drainage and metal leaching appears to be occurring at Wayside. The concentrations of metals in the drainage are likely attenuated by Carpenter Lake.

There is the potential for localized metal loading into Carpenter Lake from the oxidized tailings and lower waste rock dump.

References: *See* MINFILE

Property File 092JNE030

CONGRESS

Property name: CONGRESS
Map number (*see* Appendix C): 12
Mine drainage sample numbers: LB00-1301 to 1303
MINFILE number: 092JNE029

Date: September 5, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and clear
Regional Office: Kamloops
NTS map sheet: 092J15W
Location: at an elevation of approximately 3,000 feet on the north shore of Carpenter Lake
Access: 5 km northeast of Gold Bridge
UTM coordinates: n/a

Type of deposit: Stibnite veins and disseminations; Au-quartz veins
Commodities: Gold, Silver, Copper, Antimony, Mercury, Zinc
Years mined (open/closed): 1937

Mine Workings Inspected:

The extent of the mine is greater than the area inspected. The underground workings are about 3 km in total, accessed by 3 adits.

The gated adit is situated at ~2500 feet. The drainage from the adit was diverted to a small pipe and the water was sampled.

The waste rock dump is located down slope of the 2500 ft. portal. The dump is oxidized in patches, primarily within the fines. The oxidized fines comprised ~10% of the dump. Additionally, the waste rock is oxidized a red-brown in the flow path of the drainage. The dump is unvegetated. A series of dumps are located along the access road to the 2500 ft adit. These dumps were not inspected.

The upper adit was not located.

Mine Drainage:

The drainage from the lower portal was diverted under the access road and flowed from a pipe on the other side. From the pipe the water drained down the waste rock dump, into the surrounding forest.

Observations & Analytical Results:

The flow from the lower portal was 1 L/min. Oxidation of rocks in the path of the drainage is moderate and a red-brown colour. The field pH = 7.0-7.5 and conductivity = 830 s. No salts were observed and the water was odourless. Water was sampled directly from the pipe.

Water quality results: pH = 8.53, SO_4 = 279 ppm and hardness = 282 ppm. Arsenic is the only metal above the BC water quality guidelines for aquatic life.

- As is 1 order of magnitude higher than the water quality guidelines and is present as dissolved species.

See Appendix B for the geochemical data set.

Additional Comments:

Alkaline mine drainage and metal leaching appears to be occurring at Congress.

References: *See* MINFILE

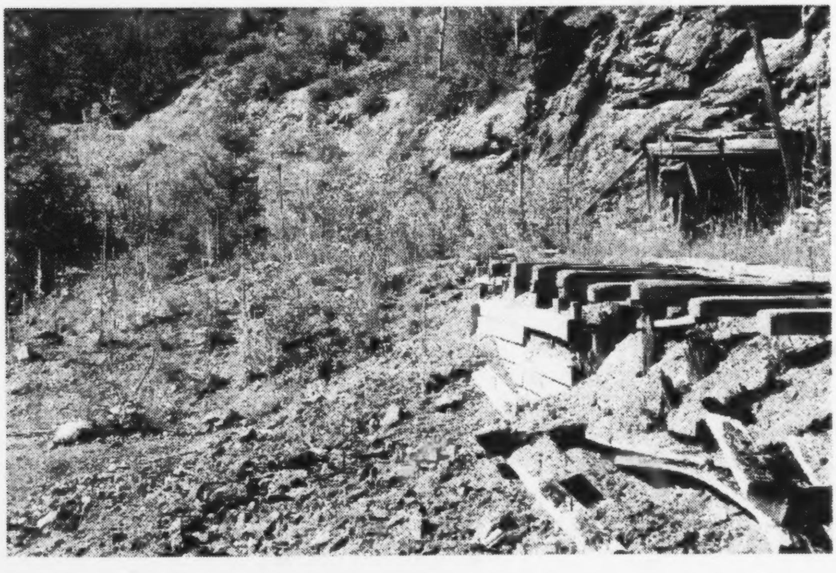


Photo 16. Congress adit (background). The drainage from the adit is draining from a small pipe, located below the tracks.

BANBURY

Property name: BANBURY

Map number (*see* Appendix C): 13
Mine drainage sample numbers: n/a
MINFILE number: 092HSE046

Date: September 6, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and clear

Regional Office: Kamloops
NTS map sheet: 092H08E
Location: west bank of Henri Creek,.
Access: access road 3.5 to 4 km west of Hedley
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities: Gold, Silver, Zinc, Copper, Lead
Years mined (open/closed): 1937

Mine Workings Inspected:

Much time was spent exploring the property for the workings. The following components were located:

- 975m backfilled portal with no drainage.
- 800m backfilled portal with no drainage. This portal was located above the main camp.
- main camp with a number of derelict, decaying wood buildings. A large building foundation was also on site. About a dozen empty cyanide barrels were stacked in one of the buildings. These barrels were from the leach operation conducted at the base of the property in the 1980s.
- water (not mine drainage) is on site. At the camp level a water tank was located.
- decaying mill foundations located on the main access road between the camp and the creek.

At the lowest level of the property, adjacent to the creek, the following was located:

- an accessible old freight train car doubling as storage. In the car were hundreds of bagged samples. A white powder was on the floor, which could potentially be arsenic.
- an old concrete heap leach pad.
- tailings from the leach operation.

Contemporary exploration has been conducted in the area. The heap leach operation was run by Noranda (MINFILE).

Mine Drainage: None observed

References: ***See* MINFILE**

DIVIDEND-LAKEVIEW

Property name: DIVIDEND-LAKEVIEW

Map number (*see* Appendix C): 14
Mine drainage sample numbers: n/a
MINFILE number: 082ESW001

Date: September 6, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: hot and sunny

Regional Office: Kamloops
NTS map sheet: 082E03W
Location: at ~550 m elevation on the eastern slopes of Mount Kruger, 3.75 km southwest of Osoyoos, B.C. Located on Crown Granted claim lots 1589 and 1899.
Access: from the town of Osoyoos
UTM coordinates: n/a

Type of deposit: Au skarn; Polymetallic manto Ag-Pb-Zn; Polymetallic veins Ag-Pb-Zn±Au
Commodities: Gold, Silver, Copper, Lead, Zinc, Bismuth, Cobalt
Years mined (open/closed): 1907-1949

Mine Workings Inspected:

The inspection was pre-empted due to health reasons.

At the base of the mountain there is an oxidized waste rock pile. The dump is strongly and pervasively oxidized to a red-orange colour to an approximate depth of 2 cm. The oxidized waste is mostly comprised of fines. The volume of the oxidized dump is in the order of 500 m^3. The dump was very dry, making the fine fraction easily transportable by wind. The dump has a very strong sulphur odour.

Located on top of the mountain, is the glory hole. The opening was never inspected. Three unoxidized waste rock dumps cascaded down the slopes from the glory hole. These dumps from a distance appeared unoxidized. At the foot of these dumps were a series of concrete foundations, possibly from the historic mill reported to be on site.

A lot of development and human activity surrounds the mine site. At the foot of the site is a recent housing development. Waste rock from the mine site has been used for terracing the development. To the north of the housing development is a golf course. The tailings are reported to be below the clubhouse. The area around the mine is a popular hiking destination.

Mine Drainage:

None observed.

Additional Comments:

Hikers frequent this area. Thus, a principle concern is the hazards to human health and safety related to the mine workings. The use of the heavily oxidized dump material as a fill material in the housing development and the mobility of the oxidized dump fine fraction are environmental concerns.

References:*See* MINFILE

Property File 082ESW001

Photo 17. Oxidized waste dump at Dividend-Lakeview.

SNOWFLAKE (Standard)

Property name: SNOWFLAKE (STANDARD)

Map number (*see* Appendix C): 15
Mine drainage sample numbers: n/a
MINFILE number: 082ESW091

Date: September 6, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and hot

Regional Office: Kamloops
NTS map sheet: 082E04E
Location: 2.5 km southeast of Burnell Lake and 3 km northwest of Oliver
Access: Fairview-White Lake Road
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Gold, Silver, Lead, Zinc, Copper
Years mined (open/closed): 1961-1962

Mine Workings Inspected:

Adit No. 2, the lower adit, has decaying boards unsuccessfully barring access. No water was draining from the adit. There were no traces of spring runoff, e.g. salts, precipitates, flow path.

The waste rock dumps are adjacent to Adit No. 2 and are comprised largely of quartz. The volume of the dumps is ~20,000 tonnes. About 10% of the dump is oxidized to a light orange-red colour.

The property has been subject to contemporary exploration.

Mine Drainage:

None observed

Additional Comments:

Small scale site with few workings.

References: *See* MINFILE

Photo 18. Snowflake adit.

TWIN LAKES

Property name: TWIN LAKES
Map number (*see* Appendix C): 16
Mine drainage sample numbers: LB00-1401 to 1403
MINFILE number: 082ESW011

Date: September 7, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast, cool and windy

Regional Office: Kamloops
NTS map sheet: 082E05E
Location: 2.25 km north of the peak of Orofino Mountain, 14 km northeast of Keremeos.
Access: turn off Highway 3A, 20 km south of Penticton and proceed e.6 km south past Twin Lakes.
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au; Au-quartz veins

Commodities: Gold, Silver, Lead, Zinc
Years mined (open/closed): 1926-1942

Mine Workings Inspected:

The workings are extensive and are situated along a network of logging and exploration roads. Exploration activities (trenching and blasting) were evident throughout the entire mine site. The workings south of the old mill site may have been from the neighbouring Grandoro mine site (082ESW010).

Two adits, the Alice adit, located northeast of the mill and an adit east of Summit shaft, were not located.

1. Old mill site

Inspected workings around the mill include the tailings, two related waste rock dumps and an adjacent adit.

The old mill is located north of the access road. Remains include old concrete foundations, scrap metal and wood as well as a collapsed wooden structure.

The tailings are deposited south of the road in a heavily forested area. Mature and immature trees grew from the tailings. Plants roots were prolific throughout the subsurface and a healthy layer of topsoil is present. The tailings are coarse (sand sized). A test pit revealed the surface layer of the tailings (~10 cm depth) is light brown and unoxidized. A bright orange-brown oxidized layer persisted until ~ 50 cm depth. The next horizon is a light orange-brown oxidized layer. Intermittent Creek, about 25 m from the road, flows through the tailings. The distance of the stream from the road was ~20-30 m. At the time of the inspection, the creek wasn't flowing but the channel sediments were saturated. The tails near the creek channel progress from a red oxidation colour to a light orange-brown with distance from the creek. At the creek, the depth of oxidation is shallower than the tailings at road. The distribution of the tailings along the roadside is about 1.25 km.

At the east end of the tailings, near the road is a 2 by 2 foot, flooded shaft with a timber frame. The shaft is accessible.

Photo 19. Open, flooded shaft near the glory hole at Twin Lakes.

Photo 20. Twin Lakes mill.

Above the mill to the north is an uncollared adit located in an open cut. The open cut faces are vegetated with grasses but appeared unstable. The portal is fenced off but accessible. Stagnant water was present but not sampled.

The adit has two related waste rock dumps situated immediately down slope. The crest and toe of the dumps are vegetated with grasses and immature trees. The waste rock is gravity sorted: the fines were at the top of the dump and the boulders at the bottom. The dump contained diorite, quartz and greenstone. The waste rock dump is oxidized locally in patches. Other visible dumps were located above but due to time constraints, were not inspected.

2. Summit shaft

At this site, the glory hole, a decline shaft, waste rock dump and an old cabin were located. No drainage was observed.

The area surrounding the glory has been roped off. The adit/workings northeast of the glory hole are sunken. The underground workings are accessible.

The waste rock dumps surround the glory hole and other underground workings. The dumps contain minor, patchy oxidation of a red-orange colour. Waste rock lithologies include diorite, greenstone, carbonates and quartz. Visible mineralization includes pyrite. The dumps are relatively unoxidized, likely due to the high carbonate content. Because the workings were caved and the waste rock was scattered, it was difficult to get an estimate of volume.

The decline shaft is partially covered by a caved wooden structure. The shaft was flooded. Access to the shaft is possible.

An old wooden cabin is still standing but its stability is unknown.

3. Workings south of the mill (Grandoro mine site?)

These workings located south of the Twin Lakes #4 claim and are possibly part of the historic Grandoro mine site (082ESW010). Two sets of workings were inspected:

a) Second right after the mill

Workings inspected include 1 adit, 1 waste rock dump and 1 shaft.

The portal is flooded and accessible. About 10 m inside, the adit is caved. The stagnant water inside was not sampled due to the instability of the portal.

The waste rock dump is located east of the adit and contains slightly oxidized disseminated pyrite. The volume of waste is in the order of 5,000 m^3. The dump lithologies include quartz vein and mafic, fine grain basalts. The size distribution of the waste ranges from fines to 8cm. Numerous mature trees are growing from the top of the dump and dark green moss is prolific. The toe of the dump hosts grasses but the slope is unvegetated.

The open shaft is accessible and not flooded. The depth of the shaft is unknown. White to light green precipitates are visible on the shaft walls.

b) Third right after the mill

Inspected on site were 3 adits (1 flooded), 1 decline, 1 shaft and waste rock dumps.

The most northeastern adit of the three is located in an open cut and flooded. The portal is partially blocked by slumped material from above but is still accessible. The water was dammed about 5 m beyond the slump, in the open cut. Cattle used this location as a watering hole. The wallrock above the portal is oxidized to a red-orange colour. Water samples were taken at this site near the portal.

A shaft is situated south of the flooded adit. This shaft is probably a source of ventilation for the now-flooded adit.

Southeast of the shaft is an unflooded, accessible decline with a depth of ~40-50 ft. The wall rock is oxidized to a red-brown colour.

West of the decline is an unstable portal with rotting timber supports. The wall rock around the portal is oxidized in patches to a white-green colour.

East of the unstable portal is an uncollared adit. The rock above the portal was ready to fail. There are white-green precipitate/salt on the wall rock, some of which were on the dark green moss growing around the portal. There is also iron oxidation (orange-red) within these rocks. Internally, the rocks didn't appear to be oxidized.

The waste rock at this site is not in discernible dumps but scattered around. The rocks (quartz, diorite & greenstone) are rich in sulphides but also contain carbonate. The disseminated pyrite in the quartz is weathered to a red colour. The greenstone and diorite are also oxidized in patches. The dump is generally unoxidized, likely due to the high carbonate content.

Mine Drainage:

The mine site was largely devoid of surface drainage.

The 2 flooded adits located south of the mill may have been part of the Grandoro property (082ESW010), not Twin Lakes.

The adit located above the old mill site contained stagnant water, which was not sampled. It is unknown if this drainage flows seasonally.

Observations & Analytical Results:

The flooded adit south of the mill was very turbid. White-green precipitate or salt-like sediment has been deposited in the water. The drainage was sampled.

Water analysis of the flooded adit south of the mill produced the following results: pH = 8.0, [SO_4] = 81 ppm and hardness =324 ppm. Metal concentrations above the BC water quality guidelines for aquatic life include Al (total - 0.5 ppm, diss - BDL) and Fe (total - 0.62, diss - BDL).

Al is of the same magnitude as the water quality guidelines; it is only slightly in excess of the 0.1 ppm threshold value. The metal is present in the drainage as colloids/particulate. The white precipitate observed was likely an Al salt or precipitate.

Fe concentration is slightly above the 0.3 ppm water quality threshold. The Fe in the drainage is colloidal/particulate.

See Appendix B for the geochemical data set.

Additional Comments:

Accessible openings throughout property pose human safety hazards.

Mill also processed ore from the neighbouring Grandoro mine.

References: *See* MINFILE

WINDPASS/SWEETHOME

Property name: WINDPASS/SWEETHOME
Map number (*see* Appendix C): 17
Mine drainage sample numbers: LB00-1501 to 1507
MINFILE number: 092P 039

Date: September 8, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: variable - ranging from sun with clouds, cold and snowy, to cold and foggy. A light dusting of snow was on the ground

Regional Office: Kamloops
NTS map sheet: 092P08E
Location: on a plateau on the southwest slope of Mount Baldie, at the north end of Dunn Lake
Access: via a private forestry road on the Cordilleran Ranch
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Gold, Copper, Bismuth, Silver
Years mined (open/closed): 1916-1944

Mine Workings Inspected:

The inspection of Windpass was cut short as it started to snow, making the access road potentially impassable. Sweethome is at a lower elevation so there was no threat of snow. In the literature, Sweethome is considered a part of the Windpass mine.

1. Windpass

Windpass is located at an elevation of 5400 ft. An adit, dump and decaying wooden structure (possibly a tram tower) were inspected on site.

The timbered adit is accessible, as the wooden door is no long attached. The exposed rocks in the open cut leading to the portal are oxidized. The water flowing from the adit was sampled.

The waste rock dump is situated on a slope below the adit. The volume is in the order of 10,000 m^3. Sparse pyrite and chalcopyrite are hosted in diorite and quartz. 95% of the dump surface is oxidized to an orange-brown colour. The top and slope of the dump are partially vegetated with immature trees and shrubs.

At the toe of the dump is a decaying wooden structure, possibly a tram tower. The tower is unstable. The ore from this site was transported down the mountain to a mill on the lake. The mill was not inspected.

2. Sweethome

The Sweethome workings are located at an elevation of 5000 ft. An adit, corresponding dump and decaying

Photo 21. Sweethome dump and decaying wooden structure (tram?).

Photo 22. Windpass portal and drainage.

wooden structure, likely a part of the tram, were inspected.

The adit of the Sweethome, situated in an open cut, is accessible. The portal is not timbered. Slumped boulders and timbers partially obstruct the portal. The ground in the adit was dry but there was surface drainage flowing from the portal. Water samples were taken. The wall rock around the portal is oxidized, but less so than at the Windpass portal.

The waste rock dump is situated to the west, down slope from the adit. The volume of material is in the order of ~10,000 m^3. The size fraction of the dump ranges from fines to boulders. The dump is oxidized in a few patches to a brown-red colour. Dump material includes milky quartz and diorite.

The mill is reported to be on Dunn Lake. The tailings, according to S. Rothman were placed in a dam/pond and have since been reworked.

Observations & Analytical Results:

1. Windpass

The drainage from the Windpass portal was flowing at a rate of ~5 L/min. The pH=5.0-5.5 and conductivity = 300 s. The water was odourless. A brown-yellow precipitate was present in the water. Bright green, stringy moss was growing in the flow of the water. Water samples were taken.

Lab results of Windpass adit drainage are: pH = 8.13, [SO_4] = 56 ppm and hardness = 123 ppm. There are no elevated metal concentrations with respect to the BC water quality guidelines for aquatic life.

2. Sweethome

The drainage from the Sweethome adit was flowing at a rate of 15 L/min. The pH = 5.0-5.5 and the conductivity = 270 s. Brown and bright green moss were growing in the water.

Water quality results: pH = 8.0, [SO_4] = 88 ppm and hardness= 181 ppm. Elevated metal concentrations above the BC water quality guidelines include Al, Cu, Fe and Mn.

- Al is 1 order of magnitude greater than the water quality guidelines. The Al is colloidal/particulate in the drainage.
- Cu is 1 order of magnitude higher than the water quality guidelines. Both dissolved and colloidal/particulate species are in the drainage.
- Fe is slightly above the water quality guidelines. The Fe is colloidal/particulate.

- Mn is slightly above the water quality guidelines. The Mn is dissolved.

See Appendix B for the geochemical data set.

Additional Comments:

MINFILE property status is listed as "developed prospect." This status does not reflect the extent of disturbance on site.

References: *See* MINFILE

HOMESTAKE (Kamad)

Property name: HOMESTAKE (L.827)
(a.k.a. Kamad Silver)

Map number (*see* Appendix C): 18
Mine drainage sample numbers: LB00-1601 to 1609
MINFILE number: 082M 025

Date: September 8, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast, intermittent rain, cool

Regional Office: Kamloops
NTS map sheet: 082M04W
Location:The workings are on Sinmax and Homestake Creeks.
Access: 4.5 km northwest of the head of Skwaam Bay on Adams Lake immediately north of the road.

UTM coordinates: n/a

Type of deposit: Noranda/Kuroko massive sulphide Cu-Pb-Zn
Commodities: Silver, Lead, Zinc, Gold, Copper, Barite, Mica
Years mined (open/closed): 1926-1941

Mine Workings Inspected:

This site was visited in four areas: 1) the lower (west) adit and dump, 2) the Homestake Creek adit and dump, 3) Homestake Creek at the foot of the property and 4) Homestake Creek diversion, located below the Homestake adit.

1. Lower (west) portal and dump

The lower portal is located west of the Homestake Creek adit. The phyllitic rocks around the portal are failing. A wooden door blocks access to the adit. The adit is flooded and water is draining from the portal. The water was sampled.

The waste rock dump is about 50 m in length and slopes at ~40 degree angle. The surface weathering of the dump is heterogeneous; the oxidation colours observed include red, yellow and dark red-brown. The degree of weathering also varies along the length of the dump. Disseminated pyrite (0.25 mm) is hosted in phyllite and schistose rocks. Iron weathering in the talc-schist appears to be the primary source of oxidation. A crust 15 cm deep covers the surface of the dump. The depth of oxidation is about 8 cm. Grasses & trees are vegetating the top and the base of the dump. The dump face is too steep to host vegetation. There are silty, saturated orange iron precipitates deposited at the toe of the dump. No direct source of the precipitates was observed.

2. East portal and adit on Homestake Creek

Homestake Creek runs through a steep gulley. The portal is on the west bank of the creek while the dump is on the east.

The Homestake adit has 2 openings: the main portal, which is timbered with a wooden door, and another small, timbered portal, which is accessible. A rotting, unstable wooden bridge crossing Homestake Creek

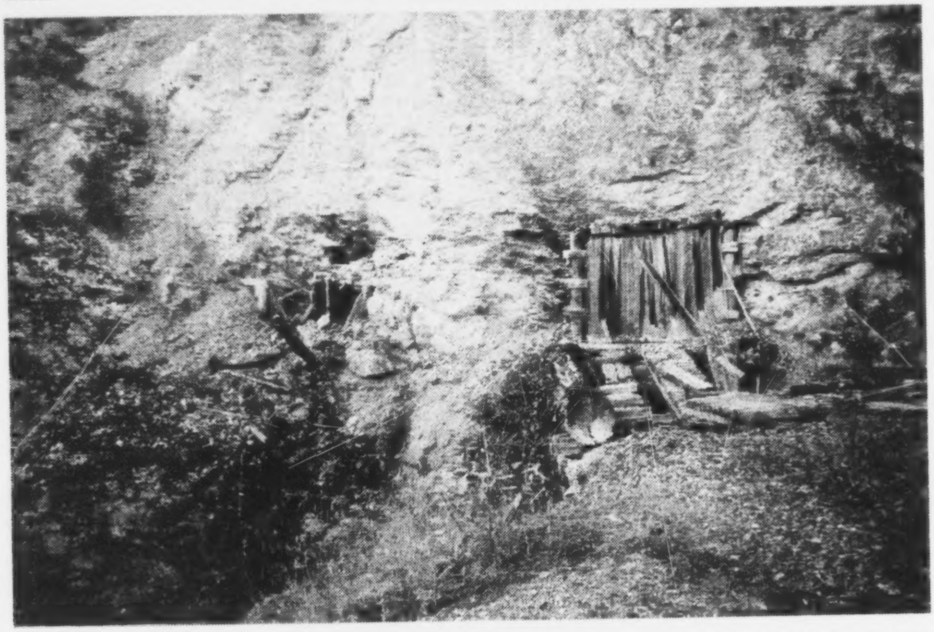


Photo 23. Homestake (Kamad) partially flooded upper adit. Homestake Creek flows beneath the bridge leading to the portal.

Photo 24. Homestake (Kamad) lower adit. Note white salts in front of the adit.

to the main portal remains. The adit is dammed and partially flooded with stagnant water. The water was draining from the adit and sampled.

The waste rock dump face slopes at an approximate angle of 35 degrees. The size of the rocks is quite small, ranging from fines to 15 cm. This may be due to the weak and fissile nature of the rocks. The weathering of the dump is differential; some areas are weathered red while others are yellow.

3. Homestake Creek at foot of mine property

The creek has been diverted at the foot of the property for irrigation purposes. The creek splits into 2; some of the water continues to flows in the original channel. The pH of the water is 5.5 and the conductivity 380. The rocks within the man made channel are stained red. The natural flow of Homestake Creek is into Siwash Creek, which is a tributary of Adams Lake. Water samples were taken.
The analytical results of the water samples show borderline total concentrations of Fe (0.32 ppm) with respect to the aquatic life WQ concentrations (0.3ppm). The lab pH = 7.9, $[SO_4\}$ = 36 ppm and H= 193 ppm.

Stream water should be sampled during freshet. The tailings were not inspected.

Observations & Analytical Results:

1. Lower (west) adit

The water draining from the lower portal was flowing at an approximate rate of 2-3 L/min. At the time of the visit, the flow from the adit was low as the area of iron precipitate deposition was greater than that of the water flow. A yellow precipitate was also present. The pH of the water was 3.5-4.0 and the conductivity registered as 1,000 s. The water had an iron odour. In the drainage path, black and green mosses and grass were present. The drainage usually runs along the side of the road although this channel was dry during this inspection. Water samples were taken outside of the portal.

The water quality results: pH = 3.35; $[SO_4]$ = 7770 ppm and hardness = 6096 ppm.

- The system is acid generating as indicated by the very high sulphate concentration. Although the buffering capacity is high, the drainage is very acid.

Elevated total metal concentrations with respect to BC water quality guidelines for aquatic life include Al, Co, Cu, Fe, Mn and Zn.

- Al is 2 orders of magnitude greater than the water quality guidelines. The Al is primarily dissolved in the drainage.
- Co is dissolved in the drainage and is 1 order of magnitude greater than the water quality guidelines.
- Cu is 0.02 ppm above the water quality guidelines and is primarily dissovled in the drainage.
- Fe is 2 orders of magnitude higher than the water quality guidelines. The Fe is primarily dissolved although there is a colloidal/particulate component in the drainage.

- Mn is 1-2 orders (variable threshold value) of magnitude higher than the water quality guidelines. The Mn is primarily dissolved.
- Zn is 1 order of magnitude above the water quality guidelines and is primarily dissolved in the drainage.

2. Adit on Homestake Creek

The stagnant water dammed in the Homestake adit has a sludge on the surface and is laden with Fe-precipitates. The depth of the water could not be determined. Runoff from the portal is low, about 10 L/min. The water was draining from the downstream corner of the portal only. The downstream rocks were heavily stained red. The pH of the drainage = 3.5. Both above and below the portal, the pH of the stream was 5.5. The drainage smelled strongly of iron.

Water quality results are: pH=3.00, $[SO_4]$=1660 ppm and hardness=1132 ppm.

- The system is acid generating, as indicated by the very high sulphate concentaation. The buffering capacity is not great enough to neutralize the water, as indicated by the low pH.

Metals in excess of the BC water quality guidelines for aquatic life include Al, Cd, Co, Cu, Fe, Pb, Mn and Zn.

- Al is 2 orders of magnitude greater than the water quality guidelines. The Al in the drainage is dissolved.
- Cd in the drainage is 3 orders of magnitude greater than the water quality guidelines. Cd is dissolved in the drainage.
- Co is primarily dissolved and is one order of magnitude greather than the water quality guidelines.
- Cu is primarily dissolved in the drainage and is 2 orders of magnitude greater than the water quality guidelines.
- Fe is 2 orders of magnitude greater than the water quality guidelines. Fe in the drainage is both dissolved and colloidal/particulate.
- Pb in the drainage is primarily dissolved and is 0.1 ppm above the water quality guidelines.
- Mn is 2 orders of magnitude greater than the water quality guidelines. Mn is dissolved in the drainage.
- Zn is 2 orders of magnitude greater than the water quality guidelines and is primarily dissolved in the drainage.

3. Homestake Creek at foot of property

The field pH = 5.5. The rocks had minor iron staining on the surface.

The analytical results of the water samples are: pH=7.9, $[SO_4]$=36 ppm and hardness=193 ppm.

- Homestake Creek successfully buffers the acidic drainage from the upper portal.

All metals with the exception of Fe are in compliance with the BC water quality guidelines for aquatic life.

- Fe is 0.02 ppm above the guidelines. The Fe in the drainage is colloidal/particulate.

4. Homestake Creek diversion

Downstream from the eastern portal situated on the Homestake Creek, is a stream diversion. The pH of the water is 5.5. Samples were not taken at this site. Red iron precipitates were deposited on the creek bed and the rocks were stained red.

See Appendix B for the geochemical data set.

Additional Comments:

ML/ARD is evident at this site. Homestake Creek attenuates the drainage from the upper portal. There are freshet concerns for both portals, but especially the upper, flooded portal. The capacity for attenuation of the acid loading from the lower (west) portal is unknown.

Extinguished permit M-094.

References: *See* MINFILE

Ministry of Energy, Mines and Petroleum Resources Open Files 1991-1, 1992-9.

ENTERPRISE

Property name: ENTERPRISE (L.651)

Map number (*see* Appendix C): 19
Mine drainage sample numbers: LB00-1701 to 1703
MINFILE number: 092ISE028

Date: September 9, 2000
Persons present: Steve Rothman (Mining Division, Kamloops) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast, cool and windy

Regional Office: Kamloops
NTS map sheet: 092I08W
Location: eastern shore of Stump Lake, straddling the highway.
Access: main road along Stump Lake
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities: Silver, Gold, Lead, Zinc, Copper
Years mined (open/closed): 1926-1952; 1979-1980 (9 tonnes mined & milled during 1979-1980 - likely exploration)

Mine Workings Inspected:

The Enterprise mine site straddles a public road. The mill, adit, waste rock and a small volume of tailings are located to the east while the tailings are to the west of the road. At the time of the inspection, the water level of Stump Lake was very high - park picnic tables were underwater. The lake is naturally very alkaline.

The adit is at the most eastern reach of the workings. The portal is 90% backfilled; access is impossible but the inside of the adit is visible. Cold air flows from the adit. Evidence of drainage was not observed. There is minimal oxidation of the backfill material blocking the portal. MINFILE documents the presence of a shaft but this was not located.

Situated below the adit to the east is an extensive waste rock dump. A drainage diversion from the adit(?) has been set up as water drains from a pipe into a barrel buried in the dump. The water overflowed from the barrel and infiltrated the dump. The water was sampled.

The waste rock dump is relatively unoxidized despite the presence of disseminated sulphides (galena, chalcopyrite, pyrite). Surface weathering is patchy. Lithologies in the dump include basalt and quartz vein. The dump slope is ~ 40 degrees. The dimensions of the dump are about 250 m long and 15 m high. The volume of the waste rock material is in the order of 10,000 m^3. The dumps are gravity sorted; the fines are located at the top of the dump and the boulders at the bottom. Trees and bushes are growing on the top and base of the dump, but not on the slopes.

Concrete mill foundations remain. No equipment was noted. About 15,000 m^3 of processed ore is at the mill site. The ore is strongly oxidized to an orange colour with trace amounts of malachite.

Photo 25. Enterprise mill foundations.

Photo 26. **The partially revegetated Enterprise tailings facility (across the road). Dump is in foreground.**

The tailings on the west side of the road are located on private property. At the time of the inspection, people were living on the tailings in motor homes and trailers. The tailings extend from the foot of the mill to the waters of Stump Lake. The tailings are oxidized to rust orange-brown, yellow green and blue-green colours. Malachite precipitation is present. The iron weathering of the tailings is inconsistent . The tailings at the foot of the mill and the western extent of the tailings are heavily oxidized on the surface to a bright orange colour. The northeast extent of the tailings is heavily oxidized in the subsurface to a bright orange-brown colour while the surface oxidation is very minor. The area of the tailings is in the order of 2,000 m^2 and the depth of the tailings on land is up to 2.5 m. Grasses and bushes grow on the tailings

Mine Drainage:

The drainage, likely originating from the adit, flowed to the surface via a pipe buried in the waste rock dump. The water infiltrated the dump.

Observations & Analytical Results:

The adit drainage was flowing from at a rate of 3.75 L/min. The field = 7.0-7.5 and the conductivity = 1,000 s. The drainage had an iron odour. The water was sampled for analysis. Medium to dark green moss was sparsely growing within the barrel.

The results from the water analysis: pH = 8.2, $[SO_4]$=2910 ppm and H=2213 ppm.

- Sulphate is in excess of the BC water quality guidelines for aquatic life.
- The system is generating acid as indicated by the high sulphate concentration. There is enough buffering capacity available as the pH of the drainage is neutral.

The concentration of metals is within compliance with the water quality standards for aquatic life.

See Appendix B for the geochemical data set.

References: *See* MINFILE

CRANBROOK REGION

PHOENIX

Property name: PHOENIX
Map number (*see* Appendix C): 20
Mine drainage sample numbers: LB00-1801 to 1803
MINFILE number: 082ESE020

Date: September 11, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm, late afternoon

Regional Office: Cranbrook
NTS map sheet: 082E02E
Location: on the site of the ghost town of Phoenix, 6 miles east of Greenwood at the elevation of 1370 m.
Access: by paved road east from Greenwood or by an all weather gravel road west from the Grand Forks section of Highway 3
UTM coordinates: n/a

Type of deposit: Cu skarn
Commodities mined: Copper, Gold, Silver, Lead, Iron
Years mined (open/closed): 1900-1978

Mine Workings Inspected:

Components inspected include the tailings, waste rock dumps and tailings pond.

The tailings appear unoxidized and are coarse grained.

The waste rock piles are extensive and on the order of 100,000 tonnes. A cursory inspection was done of the dumps. Generally, the waste rock dumps appear unoxidized. Lithologies include tuff, argillite and greenstone. Carbonates are pervasive, as tested with HCl, possibly explaining the lack of visible oxidation. Disseminated pyrite is sparsely present in the dump.

The location of the former mill is northwest of the workings, along the main road. Only the foundations remain.

Mine Drainage:

There was no water flowing into the pond but ephemeral flow channels were present. No visible salts or secondary mineralization was observed. Flow into the receiving environment was not observed.

Photo 27. Phoenix tailings, tailings pond and dumps. The workings in the background include an open pit.

Observations & Analytical Results:

The tailings pond was well vegetated with signs of habitat formation. The field pH = 5.5. No conductivity measurement was taken. The riparian zone was naturally revegetating with young plant species although there was some minor iron staining. Plants included bulrush, cat tails and horse tail. There was also a dark green moss growing in the water. Amphibians were present in the pond. The water was organic smelling. Water was sampled on the east side of the tailings.

Results from the tailings pond water analysis include: pH = 8.0, $[SO_4]$=637 ppm, hardness = 196 ppm. The concentrations of heavy metals, both dissolved and total are below the BC water quality guidelines for aquatic life.

- only parameter of concern is the SO_4 concentration, which exceeds the numeric guideline

See Appendix B for the geochemical data set.

Additional Comments:

This inspection was very cursory due to the extensive nature of the mine. This property warrants a substantial amount of time for a proper inspection. Other components include the open pit, as well as numerous other dumps. The open pit is located in the ghost town of Phoenix.

The potential mixing of water on site makes the validity of the analytical results uncertain. It is not known at this point the proportions of surface, ground and mine water in the pond.

Ore smelted in Grand Forks.

References: *See* MINFILE

TREMBLAY TAILINGS

Property name: TREMBLAY TAILINGS
Map number (*see* Appendix C): 21
Mine drainage sample numbers: n/a
MINFILE number: 082ESE262

Date: September 11, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: clear and cool, approaching dusk

Regional Office: Cranbrook
NTS map sheet: 082E02E
Location: near the ghost town of Phoenix
Access: by paved road east from Greenwood or by an all weather gravel road west from the Grand Forks section of Highway 3
UTM coordinates: n/a

Type of deposit: Tailings
Commodities mined: Copper, Gold, Silver
Years mined (open/closed): no production, only exploration

Mine Workings Inspected:

The tailings are well vegetated, a result of hydroseeding. The grain size of the tailings is coarse, especially at the dam walls where they had been cycloned. The tailings are unoxidized.

Mine Drainage:

There was no pond present although one was observed by S. Wuschke 2-3 years prior. Reference of a pond has also been made in ARIS reports. In the area of the former pond, no vegetation is present.

At the NE toe of the tailings, there was a flooded, marshy area. The source of this water is unknown and was not sampled.

References: *See* MINFILE

Photo 28. Tremblay tailings facility.

MOTHERLODE

Property name: MOTHER LODE (L.704)
Map number (*see* Appendix C): 22
Mine drainage sample numbers: LB00-1901 to 1903
MINFILE number: 082ESE034

Date: September 12, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: overcast and cool

Regional Office: Cranbrook
NTS map sheet: 082E02E
Location: four kilometres northwest of Greenwood at the elevation of 1050 metres
Access: by good gravel road, which connects the property to the Mother Lode Creek road and Greenwood
UTM coordinates: n/a

Type of deposit: Cu skarn
Commodities mined: Copper, Gold, Silver
Years mined (open/closed): 1900-1962

Mine Workings Inspected:

The open pit is known as the Greyhound pit. The oxidation of the wall rock is patchy and is an orange-brown colour. The overburden is high in sulphide minerals (pyrite, chalcopyrite, pyrrhotite and magnetite) as well as carbonate minerals (reactive HCl fizz).

Waste rock dump and tailings are not located at this site.

Mine Drainage:

The lower pit is flooded with water. White salts are present around the water. The field pH=5.5 and conductivity 1680 μs. Within the water, there are fish, brownish precipitates and dark green moss. There is no detectable odour. The water from the pit flows beneath the road but doesn't surface on the opposite side. There, the ground is only damp. The water in the pit was sampled.

Observations & Analytical Results:

The lab pH=7.98, [SO_4]=823 ppm and hardness=902 ppm. The sulphate concentration is the only parameter is above the BC water quality guidelines for aquatic life. The hardness of the water indicates the carbonates in the system are very reactive. The carbonates are buffering the acid in the system, thus explaining the non-acidic field and labs pH's.

All metal concentrations were below the BC water quality criteria for aquatic life.

See Appendix B for the geochemical data set.

Ore smelted in Greenwood.

References: *See* MINFILE

Photo 29. Motherlode flooded open pit.

JEWEL LAKE TAILINGS

Property name: JEWEL LAKE TAILINGS
Map number (*see* Appendix C): 23
Mine drainage sample numbers: n/a
MINFILE number: MINFILE uncertain, possibly 082ESE125

Date: September 12, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: overcast and cool

Regional Office: Cranbrook
NTS map sheet: 082E02
Location: northwest shore of Jewel Lake, in Jewel Lake Provincial Park
Access: 12 km off Hwy 3 east of Greenwood
UTM coordinates: 381911, 5446967

Type of deposit: unknown
Commodities mined: unknown
Years mined (open/closed): unknown

Mine Workings Inspected:

The tailings are spread over an area of approximately 300 m^2 with one pile of tailings, about 5 m high. The tailings are mostly unoxidized — there is only minor brown oxidation. The tails toe into Jewel Lake but their depth couldn't be determined. The riparian zone is well vegetated (i.e. cattails) and trees and brush are present in areas of the dump. The dumps are used recreationally as there are mountain and motorbike tracks present.

Mine Drainage:

Toe of tailings submerged in Jewel Lake.

Additional Comments:

The source of these tailings is unknown.

References:

Unknown

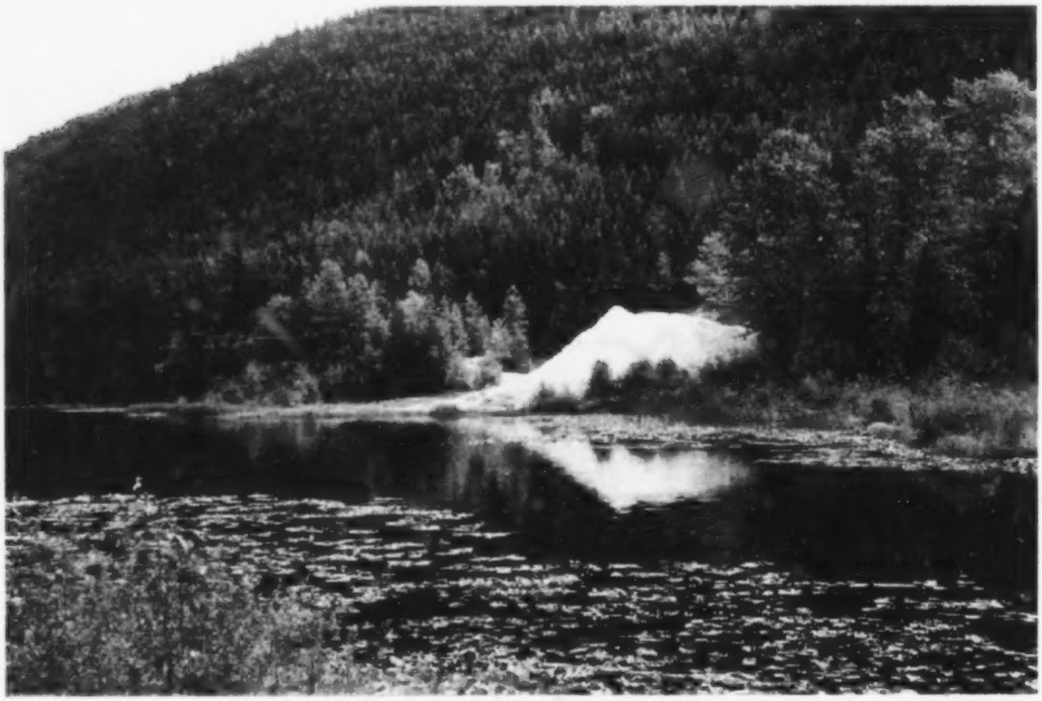


Photo 30. Jewel Lake tailings.

ORO DENORO

Property name: ORO DENORO (L.692)
Map number (*see* Appendix C): 24
Mine drainage sample numbers: n/a
MINFILE number: 082ESE063

Date: September 12, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: overcast and cool

Regional Office: Cranbrook
NTS map sheet: 082E02E
Location: 10.2 kilometres northeast of Greenwood, at elevation 1066 metres on the divide between Eholt and Fisherman creeks
Access: via the Phoenix ski mountain turnoff from Highway 3, 0.6 km north along a gravel road, which is an old rail bed. The Emma (082ESE062) is further north along the road.
UTM coordinates: 387119, 5442645.

Type of deposit: Cu skarn
Commodities mined: Copper, Gold, Silver, Cobalt
Years mined (open/closed): 1903-1917

Mine Workings Inspected:

In total, onsite adjacent to the road, there are 5 adits, an open shaft connecting one of the adits and an open pit or stope.

Of the 5 adits, 3 are open and accessible, while 2 are either backfilled or caved. One of the open adits contained stagnant water, which was not sampled. There are yellow precipitates on the wall of the adit.

The stope/open pit was flooded with water. The surface of the water was ~20 metres from the surface. The water wasn't sampled because of its inaccessibility.

Malachite and iron staining is present on the wall rocks and overburden.

The overburden contains disseminated pyrite and chalcopyrite. Massive calcite crystals (~1 cm) are also prolific.

Mine Drainage:

The adit containing the stagnant drainage was not sampled. The field pH of the water was 5.5 and the conductivity 500 µs. White salts and bright green moss were present in what appeared to be an ephemeral drainage flow path.

The subsurface flow of the water flooding the surfaced stope/open pit is unknown.

Additional Comments:

The area inspected poses to be a safety hazard, not so much an environmental. MINFILE states the workings cover 4 hectares. Only the workings adjacent to the road were inspected.

References: *See* MINFILE

Photo 31. Oro Denoro adit.

EMMA

Property name: EMMA (L.591)
Map number (*see* Appendix C): 25
Mine drainage sample numbers: n/a
MINFILE number: 082ESE062

Date: Septmeber 12, 2000
Inspectors: S. Wuschke (Mining Division, Cranbrook), L. Barazzuol (Mining Division, Victoria)
Weather: overcast and warm

Regional Office: Cranbrook
NTS map sheet: 082E02E
Location: 10.2 kilometres northeast of Greenwood, on the divide between Eholt and Fisherman creeks
Access: via the Phoenix ski mountain turnoff from Highway 3, north along a gravel road, which is an old rail bed. The Emma are north of the Oro Denoro property (082ESE063).
UTM coordinates: n/a

Type of deposit: Cu skarn
Commodities mined: Cu, Au, Ag
Years mined (open/closed): 1901-1927

Mine Workings Inspected:

Numerous surfaced, flooded stopes and an open flooded 50 m shaft.

Iron oxidation and malachite are present on the wall rock of the stopes. The stopes were flooded, with an ~50m drop to the water surface. No water samples were taken due to the inaccessibility of the water.

Mine Drainage:

Subsurface flow paths unknown.

Additional Comments:

This site is a public safety hazard with the number and depth of the openings. Some rope and fencing is present, but in general, the openings are not well marked.

Ore smelted in Greenwood.

References: *See* MINFILE

Photo 32. Stope at Emma.

SPITZEE

Property name: SPITZEE (L.2520)
Map number (*see* Appendix C): 26
Mine drainage sample numbers: LB00-2001 to 2003
MINFILE number: 082FSW121

Date: September 12, 2000
Persons present: S. Wuschke (Mining Division, Cranbrook), L. Barazzuol (Mining Division, Victoria), Phil Johnson (Granite Mountain Excavating, Rossland)
Weather: warm and overcast

Regional Office: Cranbrook
NTS map sheet: 082F04W
Location: The workings are located in the town of Rossland, in the gulley parallel to Union street.
Access: off Union Street, near the crest of the road - the workings are not visible from the road.
UTM coordinates: 0441707, 5435635

Type of deposit: Subvolcanic Cu-Ag-Au (As-Sb)
Commodities mined: Gold, Silver, Copper, Tungsten

Years mined (open/closed): 1900-1905

Mine Workings Inspected:

Workings on site include a backfilled portal and dumps. The dumps, although visible from above the gulley were not inspected.

The portal has been backfilled and a culvert installed. Drainage flowed from the culvert.

Mine Drainage:

The underground workings of the Spitzee are connected to the workings of the Le Roi (082FSW093). The Spitzee portal drains the 800 level of the Le Roi.

Observations & Analytical Results:

The drainage field pH=5.5, conductivity=540 µs and flow ~120 L/min. The drainage flows continuously throughout the year. An ironsludge-like precipitate is in the water. The area of the drainage is well vegetated, with healthy mature trees and underbrush.

The results from the water analyses include: pH=8.03, [SO_4]=300 ppm and hardness=391 ppm.

- SO_4 concentration exceeds the BC water quality criteria for aquatic life.

Metals also in excess of the aquatic criteria include Al; Cu and Mn.

- Al speciation could not be determined as the dissolved concentration was below detection (<0.2 ppm). The total concentration of Al is in excess of the guidelines by 0.1 ppm.
- Cu is one order of magnitude higher than the water quality guidelines. The dissolved concentration of Cu is below detection (<0.01 ppm) so speciation is indeterminable.
- Mn concentrations slightly exceed the threshold concentration of the water quality guidelines but are of the same magnitude. The Mn in the drainage is dissolved.

See Appendix B for geochemical data.

Additional Comments:

Located in town of Rossland.

References: *See* MINFILE

Photo 33. Drainage from Spitzee adit.

GOPHER

Property name: GOPHER (L.1050)
Map number (*see* Appendix C): 27
Mine drainage sample numbers: LB00-2101 to 2103
MINFILE number: 082FSW125
Date: September 12, 2000

Persons present: S. Wuschke (Mining Division, Cranbrook), L. Barazzuol (Mining Division, Victoria), Phil Johnson (Granite Mountain Excavating, Rossland)
Weather: warm and overcast

Regional Office: Cranbrook
NTS map sheet: 082F04W
Location: South of Rossland on Lot 1050. The Rubberhead mountain bike trail runs past the portal.
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au.

Commodities mined: Gold, Silver, Copper, Zinc, Bismuth
Years mined (open/closed): n/a

Mine Workings Inspected:

One backfilled portal with flowing drainage, situated in a forested area was inspected.

MEM recently financed the closure of the portal using Section 17.0 of the *Mines Act*. Granite Mountain Excavating performed the reclamation work (backfilling of the portal and installing a culvert). Observations of the open cut and surrounding rocks were limited as the area had recently been excavated and overturned.

Mine Drainage:

Receiving watercourse of the drainage is Trail Creek.

Observations & Analytical Results:

The field pH=5.5, conductivity 320 µs and the flow ca. 80 L/min. The water had no odour. No vegetation present in the drainage channel. The backfilling and excavation was performed recently, thereby elevating the turbidity of the drainage. Minor Fe-staining of the rocks within the drainage was visible. The drainage was sampled.

The analytical results of the water samples are as follows: pH=7.9; [SO_4]=76 ppm and hardness=219 ppm.

- All of the metal concentrations meet the BC water quality guidelines for aquatic life. However, zinc concentrations, although in compliance, are elevated.

See Appendix B for geochemical data.

Additional Comments:

Not a reclamation priority: drainage in compliance (although Zn is elevated) and the one portal has been backfilled.

References: *See* MINFILE

Photo 34. Portal backfilled with a culvert in place at the Gopher mine site. The drainage was sampled.

SECOND RELIEF

Property name: SECOND RELIEF (L.2463)
Map number (*see* Appendix C): 28
Mine drainage sample numbers: LB00-2301 to 2307
MINFILE number: 082FSW187

Date: September 13, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)

Regional Office: Cranbrook
NTS map sheet: 082F06W
Location: in a mountain valley 20 km northwest of Salmo above Erie Creek
UTM coordinates: 471077, 5463369

Type of deposit: Au skarn; Cu skarn
Commodities mined: Gold, Silver, Lead, Zinc, Copper, Molybdenum
Years mined (open/closed): intermittently between 1902-1959

Mine Workings Inspected:

Workings include: 2 backfilled portals, 2 dumps (1 minor, 1 major), mill foundation, oxidized tailings.

Two portals are located at the eastern extent of the property, above the mill foundation and wooden cribbing:

- The upper portal was not draining water at the time of the inspection. Whether it drains during freshet is unknown. Outside of the portal is well vegetated and a black layer of topsoil is present.
- The lower portal is at an elevation of 3350 m. The portal has been closed with a culvert, from which drainage was flowing.

The tailings are located north of the main waste rock pile and west of the mill foundations, across the road. The elevation of the tailings is 3300 feet. The area is approximately 1 hectare. The tailings are pervasively oxidized to a red-brown colour >0.5 m deep. Within the 0.5 m oxidized layer, there was a 1 cm horizon of unoxidized tailings. Mature trees were growing in the centre area of the tailings and appeared robust. The tailings dam was composed of waste rock.

Tailings are also located east of the waste rock dump. A layer of topsoil and vegetation (trees, shrubs etc.) covers these tailings. The tailings are oxidized in the subsurface. The distribution and depth of these tailings was not determined.

The main waste rock dump is composed of greenstone and quartzites. The layout of the dump material is in multiple fingers, one of which forms the tailings dam. The dump is heavily oxidized in patches. The volume is on the order of 100,000 tonnes. Visible mineralization includes disseminated pyrite and chalcopyrite. The drainage from the upper adit flows through this dump and resurfaces at the southern toe of the dump.

Mine Drainage:

The drainage from the lower portal infiltrates the ground above the mill, located to the west, and flows through/beneath the small upper waste rock dump and mill foundations. The water resurfaces into a ditch located at the toe of the mill and, flows westward under the road where it continues to infiltrate the tailings and lower (main) waste rock dump. The drainage flows from the toe of the main dump and is received by a marshy area, which likely acts as a natural buffer to the drainage.

Observations & Analytical Results:

1. Lower portal

The drainage flowed from the lower portal at ~20L/min. The field pH=5.0-5.5 and conductivity = 110 µs. The water was odourless. There were no visible precipitates but some sparse staining (Fe) was evident on the surface of submerged rocks. The drainage was sampled directly outside the portal.

The water quality results of the drainage from the lower portal are: lab pH= 8.0, [SO_4]=16 ppm and the hardness=75 ppm. The metal content of the drainage is within the limits for the BC water quality guidelines for aquatic life.

2. Toe of main waste rock dump

The water flowing from the southern toe of the waste rock dump is very turbid. The field pH=5.5 and conductivity = 80 µs. Red-brown Fe precipitate is suspended in the water and has also deposited to form a sediment 10 cm deep. Vegetation includes horsetails and mature trees, both in stable and healthy condition. The flow was too difficult to estimate given the large area and differential flow rates.

The water quality results from the toe of the dump are as follows: pH=6.8, [SO_4]=45 ppm, hardness=48 ppm. Metal concentrations above the BC water quality guidelines for aquatic life include Al, Cu, Fe, Mn and Zn.

- Al speciation could not be determined as the dissolved concentration is below detection (<0.2 ppm). The total concentration is above the guidelines by 1 order of magnitude.
- Cu in the drainage is dissolved. The concentration exceeds the guidelines by 1 order of magnitude.
- Fe is above the guidelines but of the same magnitude. There is a small dissolved component of Fe in the drainage, but it is primarily as colloids and precipitates.

Photo 35. Waste rock dump and oxidized tailings impoundment.

- Mn results are questionable due to the large error in the dissolved metals duplicate. The total concentrations of Mn are slightly above the threshold of water quality guidelines.
- Zn is dissolved in the drainage and is in excess of the guidelines by 1 order of magnitude.

See Appendix B for complete geochemical data set.

Additional Comments:

The issue at this site is alkaline rock drainage and metal leaching. It appears that the water flowing through the dumps and tailings is the source of elevated metal concentrations, not the direct adit drainage. Metals in excess include Al, Cu, Fe, Zn and possibly Mn. The receiving wetlands likely act as a natural metal buffer. There is likely seasonal variation in the metal loading from the waste rock dumps.

Mercury amalgam was used for gold recovery in early stages of production. Solid mercury has been found in the ditch at the toe of the mill, although not on this inspection (S. Wuschke, pers. comm.).

The underground workings are extensive; the main vein has been opened on 11 levels. The workings observed at this site may not represent the mine site in its entirety, as more openings may be located at higher elevations.

References: *See* MINFILE

YMIR TAILINGS

Property name: YMIR TAILINGS (Dundee/Yankee Girl (L.7712))
Map number (*see* Appendix C): 29
Mine drainage sample numbers: LB00-2401 to 2403
MINFILE number: 082FSW067 / 082FSW068

Date: September 13, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny, clear and warm

Regional Office: Cranbrook
NTS map sheet: 082F06E
Location: on the east bank of the Salmo River, just south of its confluence with Ymir Creek, across from the hotel in the town of Ymir
Access: from town of Ymir
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Gold, Silver, Lead, Zinc, Cadmium
Years mined (open/closed): 1899-1951

Mine Workings Inspected:

Only the tailings were inspected. The ore source of the tailings was determined to be the Yankee Girl (082FSW067) and Dundee (082FSW068) through research after the inspection.

The tailings are deposited along the east bank of the Salmo River, across from the town of Ymir. During freshet, the river floods and entrains the tailings, washing them downstream. Erosion channels are present on the tailings. S. Wuschke indicated the volume of the tailings had decreased since his last inspection.

The tailings are heavily oxidized. The colour of the weathering is heterogeneous: copper (green-yellow) and iron (red-orange) patches. A mound of lithified, heavily Fe-oxidized tailings, on the order of 2 m^3 is situated by the river. The tailings are oxidized in the subsurface.

A pool of stagnant water ~2x6m was present at the far reaches of an erosion channel. The stagnant water was sampled.

The tailings have sparse and patchy coverage of shrubs and grasses. Generally though, the tailings are devoid of plants.

The tailings are accessible by the public. Tire marks cover the tailings. This access is a hindrance to the encroachment of natural revegetation.

Mine Drainage:

The tailings form the riverbank and are seasonally flooded during freshet.

Photo 36. Ymir tailings impoundment on the Salmo River.

Observations & Analytical Results:

The stagnant pool of water had a pH=4.5 and conductivity=740 µs. An oily, likely organic film coated the surface of the water. Pervasive Cu and Fe staining was prevalent around the stagnant pool of water.

Water quality results are: pH=4.9, $[SO_4]$=410 ppm and H=349 ppm.

- water is acidic and the sulphate concentration exceeds the BC water quality guidelines for aquatic life.

Metals in excess of the water quality guidelines for aquatic life include Al, Cd, Co, Cu, Fe, Pb, Mn and Zn.

- Al is dissolved in the drainage and is 2 orders of magnitude greater than the guideline threshold concentration.
- Cd is 1 order of magnitude greater than the guidelines and is of a dissolved species.
- Co is 1 order of magnitude greater than the guidelines and is dissolved in the drainage.
- Cu concentration slightly exceeds the guidelines but is of the same magnitude. The Cu is dissolved in the drainage.
- Fe species in the drainage are both dissolved and colloidal/precipitate. The dissolved concentration is in excess of the guidelines by about 0.4 ppm while the colloidal/precipitate fraction is 1 order of magnitude greater.
- Pb is slightly above the threshold values. The Pb in the drainage is primarily dissolved.
- Mn in the drainage is primarily dissolved and is 1 order of magnitude greater than the guidelines.
- Zn is 2 orders of magnitude greater than the water quality guidelines and is dissolved in the water.

See Appendix B for the geochemical data set.

Additional Comments:

There is a high potential of metals releasing from the tailings and concern over the tailings washing down the creek. The effects of evaporation may be elevating the concentration of metals in the stagnant water. The Ministry of Environment, Lands and Parks is conducting a preliminary study of the impact of the tailings on aquatic life (*see* reference below).

Genetically, they are linked to the Yankee Girl and Dundee properties, which were amalgamated in 1940. The workings at these properties, located at approximately 900 m in elevation, were not inspected. Ore was transported to the mill by tram.

References: *See* MINIFLE

Property files 082FSW067 / 082FSW068

Roome, R., 2002. Yankee Girl Tailings Environmental Assessment Report, Ministry of Water, Land and Air Protectioin, Nelson, R.C (unpublished report).

KENVILLE

Property name: KENVILLE
Map number (*see* Appendix C): 30
Mine drainage sample numbers: n/a
MINFILE number: 082FSW086

Date: September 14, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: warm and slightly overcast

Regional Office: Cranbrook
NTS map sheet: 082F06W
Location: main camp: east side of Eagle Creek, 11 km west of Nelson
Tailings: West Arm of Kootenay Lake in the Blewett area, 5 km west of Nelson
Access: main camp is located past the town of Blewett and up Kenville Mine Road
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities mined: Silver, Gold, Lead, Zinc, Copper, Cadmium, Tungsten
Years mined (open/closed): 1890-1954

Mine Workings Inspected:

The tailings are located adjacent to the West Arm of Kootenay Lake. The tailings show no visible sulphide oxidation. This could be due to the metals already having been leached out as each spring the tailings are flooded by the lake (S. Wuschke). The host rock of the ore was quartz veins. Natural revegetation has occurred (mature trees) but the trees have a patchy distribution. Those areas without regrowth have been subjected to 4-wheel drive traffic as indicated by the numerous tire tracks on the tailings. A barricade, barring access to the tailings would be needed for vegetation to be successfully established.

At the main site, workings include two portals, a mill and a lot of debris. Waste rock dump was not observed on site.

The lower adit drains the underground workings. The portal is collapsed but gated. The drainage from the adit was not sampled.

Mill buildings are on site although they were largely in disrepair. Pipes leading to the mill were leaking water although the source was the creek.

Mine Drainage:

The flow from the lower portal drains directly into Eagle Creek. Water samples were not taken at this site.

Observations & Analytical Results:

Drainage from the portal was flowing at a rate of 70-80 L/min. The pH=5.5 and conductivity=350 µs. There were no visible precipitates or salts. The drainage flows through tall grasses. Dark green moss is within the drainage. The water had no odour.

Additional Comments:

The land and mineral tenure is held by Crown Grant.

References: *See* MINFILE

ARIS 22433 - elemental analysis of tailings

Photo 37. Kenville tailings.

QUEEN VICTORIA

Property name: QUEEN VICTORIA (L.368)
Map number (*see* Appendix C): 31
Mine drainage sample numbers: n/a
MINFILE number: 082FSW082

Date: September 14, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny and slightly overcast

Regional Office: Cranbrook
NTS map sheet: 082F06W
Location: 11 km west of Nelson near the settlement of Beasley
UTM coordinates: n/a

Type of deposit: Cu skarn
Commodities mined: Copper, Silver, Gold
Years mined (open/closed): 1907-1961

Mine Workings Inspected:

The historical workings include underground and surface workings.

The large open stope appeared to be the main source of ore. The wallrock is gossanous: bright green malachite and iron oxide are evident. Stagnant water was pooled in the bottom of the stope. The water wasn't sampled due to the high content of pack rat excrement in the stope. The stope is a popular camping and party area as indicated by the garbage, camp fire remnants and graffiti. The stability of the stope is unknown. There are adits driven at height, making them inaccessible for observation.

To the southwest is another set of workings, including an open pit and an underground working. The underground working is not easily accessible as it is perched on a ledge. It appeared to be an adit or a small stope.

The waste rock dumps are located near the surface workings. The cumulative volume of the dumps is relatively small (on the order of 10,000 m^3) given the extent of the workings. Mineralization includes disseminated and clusters of pyrite and chalcopyrite. Malachite and iron oxides are visible weathering products. The lithologies of the waste rock are garnetite and quartzite.

Photo 38. Queen Victoria stope.

Two deteriorating wooden buildings are located up slope of the workings.

Mine Drainage:

Stagnant water was pooled in the bottom of the stope. The water was not sampled due to the high content of pack rat excrement in the stope. The water may drain from the stope into the receiving environment during freshet but this must be confirmed by an inspection in the spring.

References: *See* MINFILE

KOOTENAY FLORENCE

Property name: KOOTENAY FLORENCE
Map number (*see* Appendix C): 32
Mine drainage sample numbers: LB00-2501 to 2503
MINFILE number: 082FNE016

Date: September 14, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny and warm

Regional Office: Cranbrook
NTS map sheet: 082F15W
Location: west side of Kootenay Lake between Cedar Creek and the South Fork of Woodbury Creek. The mill is visible from Highway 31.
Access: via the road to Cody Caves. Take the first left, which is adjacent to a house. The workings are located on the other side of the large lot.
UTM coordinates: 506501, 5512306; elevation: 868 m

Type of deposit: Polymetallic manto Ag-Pb-Zn
Commodities mined: Silver, Lead, Zinc, Gold, Cadmium
Years mined (open/closed): 1912-1972

Mine Workings Inspected:

Of the 2 reported adits, only the lower adit was inspected. Westmin/Boliden has backfilled the adit with 3 culverts. Drainage flowed from only one of the culverts.

Mill foundations are present on site. They are situated downslope of the portal, above Kootenay Lake. Some scrap metal is on site. In the lake at the foot of the property, old docking pillars still stand where the ore was loaded onto steamships and transported for processing.

Reports state the tailings from the mill were dumped into the lake.

No waste rock dumps were observed.

Mine Drainage:

The drainage flows down slope from the portal to the highway, where it enters a culvert and directly drains into Kootenay Lake. The rocks at the outflow of the culvert are stained red.

Observations & Analytical Results:

The flow rate of the drainage from the portal was high, approximately 120 L/min. The field pH=5.5-6.0 and the conductivity=910 μs. The odour of the drainage was slighly sour. Horse tail grew sparsely in the drainage. Iron precipitate (orange-red) was prolific - it was widespread but appeared to be a coating only. The iron precipitate was present over the entire flow path of the drainage (to the highway).

Water quality results are as follows: pH=7.7; $[SO_4]$=412 ppm and H=580 ppm.

- SO_4 concentration is in excess of the BC water quality guidelines for aquatic life.

The concentrations of Fe, Mn and Zn are in excess of the BC water quality guidelines for aquatic life.

- For Fe, the dissolved concentration is below detection where as the total is one order of magnitude above the water quality guidelines ([Fe]=7.13 ppm). Thus, the Fe species are in precipitate (as observed) or colloidal form.
- The total Mn concentration is slightly above the threshold value of the water quality guidelines. The total concentration of Mn is lower than that of dissolved, which is possibly due to contamination during filtering.
- Zn concentrations, in both dissolved and totals forms, are in excess.

See Appendix B for the geochemical data set.

Additional Comments:

Tailings were dredged up from the lake and re-milled, likely for Zn.

References: *See* MINFILE

Photo 39. Mine drainage from Kootenay Florence adit. The portal was backfilled and 3 culverts installed.

HIGHLAND

Property name: HIGHLAND (L.258)
Map number (*see* Appendix C): 33
Mine drainage sample numbers: LB00-2601 to 2603
MINFILE number: 082FNE015

Date: September 14, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: hot and sunny

Regional Office: Cranbrook
NTS map sheet: 082F15W
Location: about 1.6 km west of Kootenay Lake and 300 metres north of Cedar Creek
Access: main forestry road running along ~900 m contour, west of the Cody Caves access road. The road is marked on the NTS map sheet and reaches a dead end on the north side of Cedar Creek. The trail head to the portal is hidden - it is downslope of the main forestry road. The trail is well cut once found.
UTM coordinates: 505317, 5510899; elevation: 802 m

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Silver, Lead, Zinc, Cadmium, Gold
Years mined (open/closed): 1896-1954

Mine Workings Inspected:

Only the lower portal, which acted as the main haulage tunnel, was inspected. The portal was closed with 3 culverts, about 2 years prior by Westmin/Boliden. Drainage was flowing from the adit. There was a pressure blow out at this portal prior to it being backfilled. The portal became blocked and dammed the drainage. Red iron precipitate still is plastered 4 metres up the tree trunks.

Higher elevation portals are documented but were not inspected or located.

Also on site is a deteriorating tramline and loading station. The wooden structure was used as a loading station and is collapsed. The line is on the ground and travels upslope from the inspected adit, possibly leading to the other workings. The terminus of the line is unknown. The tram tower has fallen since S. Wuschke's last inspection (~2 years prior).

No waste rock dumps were observed on site.

Mine Drainage:

From the portal, the drainage flows downslope a few hundred metres, directly into Cedar Creek.

Observations & Analytical Results:

The flow rate of the drainage from the lower portal was approximately 80 L/min. The pH=5.5, the water had a metallic odour and conductivity=750 µs. Fe-precipitate was flowing heavily from the adit. The drainage path was lined with the orange-red precipitate down to where the drainage flowed into Cedar Creek (a couple hundred metres below). The rocks outside of the portal were stained red from the drainage. Water samples were taken.

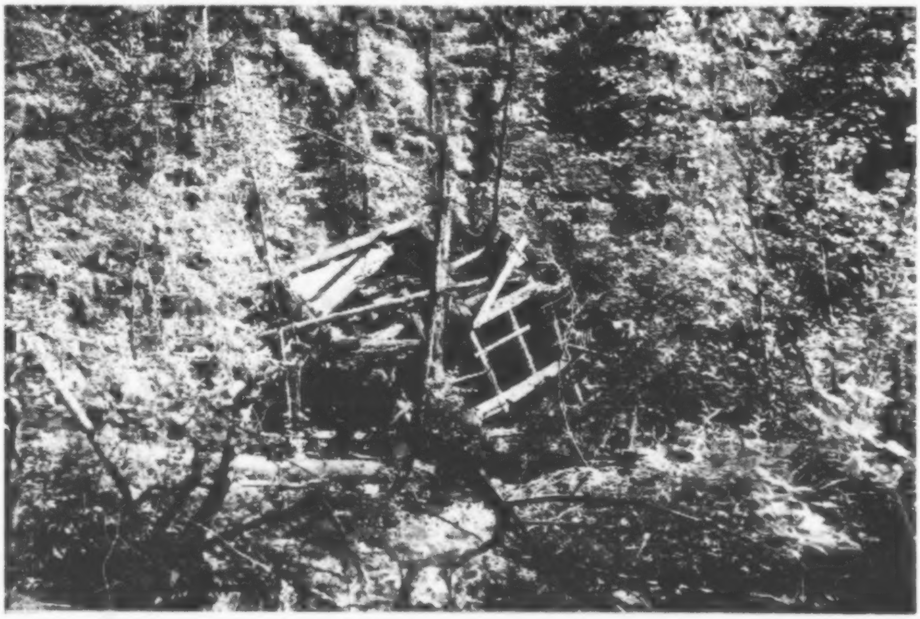


Photo 40. Collapsed tram load out station at Highland mine site.

The water quality results are as follows: pH=7.4, $[SO_4]$=497 ppm and H=557 ppm. The sulphate concentration exceeds the BC water quality guidelines for aquatic life. Metals in excess include Al, Cd, Co, Fe, Mn and Zn.

For Al, the dissolved concentration is less than the total, which implies the Al is largely in a colloidal fraction. The dissolved fraction of Al is not above the water quality guidelines for aquatic life nor drinking water thresholds.

The total and dissolved concentrations of Cd are both 0.01 ppm, implying that the Cd species are in dissolved form. The concentration of Cd is 3 orders of magnitude above the aquatic life water quality guidelines.

Co concentrations, for both dissolved and total are equal (0.01 ppm). Co resides in the drainage as a dissolved species and is 1 order of magnitude above the water quality guidelines.

For Fe, the species are partitioned between both colloidal and dissolved fractions. Both species concentrations exceed the water quality guidelines. The dissolved fraction is of the same order of magnitude as the threshold value and the total fraction is 2 orders of magnitude higher.

Mn is in the dissolved form and exceeds the water quality guidelines, but is of the same magnitude as the threshold value. The concentration of dissolved Mn is greater than the total concentration, which points to an error in analytical protocol.

Zn is primarily dissolved and is one order of magnitude greater than the water quality guidelines.

See Appendix B for the geochemical data set.

References: *See* MINFILE

CANEX TAILINGS

Property name: CANEX TAILINGS
Map number (*see* Appendix C): 34
Mine drainage sample numbers: LB00-2701 to 2703
MINFILE number: 082FSW010, 082FSW009, 082FSW247, 082FSW310, 082FSW011, 082FSW218

Date: September 15, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny and warm but slightly overcast

Regional Office: Cranbrook
NTS map sheet: 082F03E
Location: the west side of Hwy 3, south of Salmo near Sheep Creek
Access: Hwy 3, south of Salmo near Sheep Creek
UTM coordinates: n/a

Type of deposit: W skarn
Commodities mined: Lead, Zinc, Silver, Cadmium, Tungsten, Molybdenum, Bismuth, Gold
Years mined (open/closed): 1906-1970

Mine Workings Inspected:

Only the tailings were inspected. The source of the ore was determined after the inspection.

The tailings are deposited as a large mound with steep slopes. A series of houses, which are occupied, have been built on top of the dump. The housing restricted the access to the tailings - the road was gated and a guard dog was on the property.

The extent and volume of the tailings is unknown as an estimate of the dimensions wasn't possible. The tailings were silt sized and appeared unoxidized. Digging into the tails from the side of the bank, there wasn't any observable sub-surface oxidation and the tailings were dry. The slope of the tailings dump was sparsely vegetated.

A semi-stagnant marsh/pond is located between the tailings and the highway. This water was sampled.

Mine Drainage:

Surface flow paths of the marsh/pond were not evident. A sub-surface flow component may exist.

Observations & Analytical Results:

The stagnant marsh/pond had a field pH= 5.5 and conductivity=230 μs. The water had an organic, semi-rotten smell to it. Sedge (riparian plants) was growing in and near the shallow water and was especially dense at the northern limit of the pond. Healthy, mature trees were present around the periphery of the pond. The water was sampled for further analysis, as this site has been a concern for the Cranbrook regional office.

Water quality results are as follows: pH=8.1, [SO_4]=37 ppm and H=104 ppm. Elevated metal concentrations above the BC water quality guidelines for aquatic life include Al and Fe.

Both Al and Fe are primarily in the water as colloidal species, given that the dissolved concentration is proportionally high relative to the total. The problem with the water quality results is one of source: does the water interact with the tailings before settling into the marshy pond or is it independent of them?

See Appendix B for the geochemical data set.

References: *See* MINFILE

Photo 41. Pond at toe of the Canex tailings.

MIDWAY

Property name: MIDWAY
Map number (*see* Appendix C): 35
Mine drainage sample numbers: LB00-2801 to 2806
MINFILE number: 082GSW021

Date: September 15, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: warm, bright and overcast

Regional Office: Cranbrook
NTS map sheet: 082G04W
Location: North side of Highway 3 east of Yahk. The Moyie River is visible to the east.
Access: located directly on Highway 3 between Moyie and Yahk.
UTM coordinates: n/a

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Lead, Zinc, Silver, Gold, Copper, Tin, Antimony
Years mined (open/closed): 1933-1962

Mine Workings Inspected:

Two portals and two waste rock dumps were inspected, which matches the inventory given by MINFILE.

The upper portal is located at the crest of the upper waste rock dump. The portal was gated and appeared to be in stable condition. The upper portal has tracks from the adit leading to a small trestle, which was an end dump for the upper waste rock dump. The trestle is deteriorating. A trickle of water (2-3 L/min) was draining from the adit. The water was sampled.

The upper waste rock dump was formed by end dumping waste rock directly from the adit. The resultant is a gravity separated, two level dump mostly comprised of fines. The dump volume is approximately 7000 m^3 and the slope of the dump face is about 40 degrees. Rock lithologies include sandstone and milky quartzite. Although there is no visible mineralization, the rocks and fines are heavily weathered. The waste rock (10-40 cm) has oxidized to one of 2 colours: a red-brown or black-brown colour. The oxidation of the fines varies between the upper and lower levels of the dump. The upper level of the dump is a yellow-brown colour with some patches of light green oxidation. The lower portion of the waste dump is mainly comprised of oxidized, orange-brown fines. The lower waste rock fines were sampled. There was no vegetation growing on the dump.

The lower portal is located at the foot of the upper waste rock dump and to the northeast. The portal was gated and appeared to be in stable condition. Water was draining from the adit. The drainage was sampled, but downstream of the portal.

The lower dump is situated directly below the lower adit. The dump is mostly comprised of oxidized fines of a yellow-brown and brown-orange colour. The fines of the upper reaches of the dump are lithified. It appears that some waste rock in the lower reaches of the dump has been removed. The volume of the dump is approximately 3100 m^3.

Mine Drainage:

Both the upper and the lower portals were draining water.

The drainage from the upper portal flowed down the south side of the waste rock dump into the surrounding forest. The fate of the drainage is unknown.

The water from the lower adit drains down the lower dump, continues north around the toe of the dump, and east through a culvert under the highway where it drains into a marshy area of anomalously tall (1.25 m) horsetail. The drainage was sampled at the draining end of the culvert because the water becomes more acidic through the chemical interaction with the oxidized, lower dump.

Observations & Analytical Results:

For both portals, there does not appear to be a relationship between pH and sulphate concentration; the concentration of sulphate is low given the acidic nature of the drainage. Metal leaching is a definite concern. Similar suites of metals are leaching from both portals (Al, Co, Fe, Mn and Zn), except As and Cu, which are exclusive to the upper portal.

1. Upper portal drainage

The drainage from the upper portal was precipitating a red-brown Fe-oxide. Judging from the distribution of the precipitate on the ground, the drainage was at low flow. The pH=4.0 and conductivity 390 µs. The water was odourless. No vegetation was present. The drainage was sampled for analysis.

Results from the water quality analysis of the upper adit drainage are: pH=3.85, $[SO_4]$=160 ppm and H=94 ppm. Metal concentrations above the BC water quality guidelines for aquatic life thresholds include Al, As, Co, Cu, Fe, Mn and Zn.

- Al is 1 order of magnitude higher than the guidelines, for both dissolved and total concentrations. Proportionally, most of the Al in the drainage is dissolved.
- As is mainly in a colloidal form, and is 1 order of magnitude greater than the guideline threshold.
- The Co in the drainage is dissolved and is 2 orders of magnitude above the guidelines threshold concentration.
- Cu is of the same magnitude as the guidelines for both dissolved and total concentrations. Of the Cu

Photo 42. Mine drainage at the foot of the lower dump. The drainage originates from the lower adit and terminates in a field of horsetail.

in the drainage, most is in the dissolved form rather than colloidal.

- Fe exists as both dissolved and colloidal/precipitate species: it is 1 order of magnitude higher than the guideline threshold value for the dissolved concentration and 2 orders of magnitude greater for the total concentration.
- All of the Mn is in a dissolved form, which is slightly above the water quality guideline threshold.
- The Zn component of the drainage is dissolved. Zn is 1 order of magnitude above the water quality guidelines.

2. Lower portal drainage

The drainage from the lower portal was flowing at a rate of ~10 L/min and precipitating an orange Fe precipitate. The drainage had a strong metallic odour. The field pH = 5.0 and conductivity=390 μs. There was no vegetation within the water although the water flowed through some dispersed, mature trees. The drainage flowed east down the lower waste rock dump.

The drainage from the lower portal as tested after it flowed over the lower waste rock dump and through the culvert under the highway had a field pH=3.5, conductivity=530 μs and a flow of <1.0 L/min. The ground was heavily laden with orange precipitate and the water had an organic oily film on the surface of the water. The culvert was very corroded, undoubtedly from the acidic drainage. The lower pH and increased conductivity values at the culvert prompted the sampling of the drainage after its interactions with the lower dump.

Water quality results from the lower adit as sampled at the culvert, are: pH=3.3, $[SO_4]$=256 ppm and H=150 ppm. Metals in excess of the BC water quality guidelines are Al, Co, Fe, Mn and Zn.

- Al is 1 order of magnitude higher than the water quality guidelines for the dissolved concentration and 2 orders of magnitude for the total concentration. Al is primarily in the dissolved species.
- Co is 1 order of magnitude greater than the water quality guidelines. The Co is in the dissolved species.
- Fe is both dissolved and as colloids/precipitates in the drainage. The dissolved concentration is 1 order of magnitude greater than the guidelines, whereas the total concentration is 2 orders of magnitude higher.
- Mn is dissolved in the drainage exceeds but is within the same magnitude as the BC water quality guidelines. Some error exists in the Mn concentrations reported as the dissolved concentration is greater than the total.
- Zn values are also erroneous as the dissolved concentration is greater than the total. Zn is dissolved in the drainage and is in excess of the BC water quality guidelines, but of the same order of magnitude as the threshold value.

See Appendix B for the geochemical data set.

Additional Comments:

This site has ML/ARD concerns and should be sampled during freshet. The area of disturbance is small scale and is very accessible.

References: *See* MINFILE

CORK-PROVINCE

Property name: CORK-PROVINCE
Map number (*see* Appendix C): 36
Mine drainage sample numbers: LB00-2901 to 2903
MINFILE number: 082FNW094
Date: September 18, 2000

Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: overcast and warm

Regional Office: Cranbrook
NTS map sheet: 082F14E
Location: south of Keen Creek, just west of the mouth of Ben Hur Creek
UTM coordinates: 494509, 5528382; elevation: 1068 m

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Silver, Zinc, Lead, Cadmium, Gold, Copper
Years mined (open/closed): 1900-1966

Mine Workings Inspected:

Only one portal, located southeast of the dumps above the road was inspected although MINFILE documents at least 4 adits and a vertical shaft. The portal is partially blocked by slumped debris and the roof of the portal is failing. No oxidation, precipitates or salts were observed. A draft was coming from the adit, indicating an open shaft. Water was draining from the adit and was sampled.

A small waste rock dump is located east of the road and adjacent to the portal. The volume of the dump is approximately 1000 m^3.

The main waste rock is west of the road and adjacent to the old mill. The volume of the waste rock is approximately 250,000 m^3. A deteriorating wooden framed structure is situated on top.

The silt-sized tailings are located down slope from the waste rock dump and the mill. Keen Creek runs along the northwest side of the tailings, likely washing some of the tailings downstream. The colour is chocolate brown, which is consistent with depth. The tailings forming a bank above the creek hosted various seeps as well as an embedded pipe. No drainage was flowing from the pipe. The inaccessible seeps created red stains and sustained some vegetation. Vegetation on the slope of the tailings includes conifers, thick, dark green-brown moss mats, horsetail and grasses. The top of the tailings is sparsely vegetated with sparse horsetail but most of the vegetation was on the creek-side slope. The tailings fizzed rapidly with HCl indicating carbonates. A spillway leading to the creek is located on the west side of the tailings impoundment. The area of the tailings is about 15,000 m^2 and the volume about 300,000 m^3. The tailings were sampled.

Remnants of the mill include the foundations as well as scrap metal and wood.

Photo 43. Cork Province tailings.

Photo 44. Cork-Province mill.

Mine Drainage:

The drainage flowing from the adit infiltrates the ground.

Seeps from the tailings were observed but not sampled due to their inaccessibility.

Observations & Analytical Results:

The drainage from the adit was flowing at a rate of ~35 L/min. The field pH paper=5.0-5.5 and the conductivity=120 μs. The water was odourless and very cold. Water samples were taken for further analysis. Horsetail was growing in the vicinity.

Water quality results are as follows: pH=8.05, $[SO_4]$=36 ppm and H=114 ppm. Only Zn is above the water quality guidelines for aquatic life.

- Zn is one order of magnitude above the water quality guidelines and present as a dissolved species only. There is obviously some degree of error in these Zn values given the dissolved concentration is greater than the total. The source of this Zn may be some from sort of Zn-oxide, a weathering product of sphalerite.

See Appendix B for the geochemical data set.

Additional Comments:

The drainage is neutral/basic, sulphate concentrations are low, the hardness is low and no other metals other than Zn are concentrated in the waters.

References: *See* MINFILE

CAMBORNE

Property name: CAMBORNE TAILINGS
Map number (*see* Appendix C): 37
Mine drainage sample numbers: LB00-3001 to 3003
MINFILE number: 082KNW076??, 082KNW064 ??

Date: September 18, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: overcast and cool. The onset of dusk hurried the completion of the inspection.

Regional Office: Cranbrook
NTS map sheet: 082K13E
Location: Trout Lake area
UTM coordinates: n/a

Type of deposit: n/a
Commodities mined: n/a
Years mined (open/closed): n/a

Mine Workings Inspected:

There were few workings present at the site of the tailings. Mine infrastructure included a mill, an ore tunnel and tailings.

An adit, which probably served as ore tunnel, is located upslope of the mill and above a small debris/waste rock dump. The wooden structure adjoining the portal has since collapsed. Access to the adit is partially obstructed by rotting wood and corrugated metal sheets, although it is still accessible. Rail tracks and stagnant water were present in the adit. It is uncertain which mine site this adit adjoins. Water samples were taken despite this water being stagnant.

The mill foundations are adjacent to the ore tunnel to the southwest. A creek of an unknown name is located to the west. There is scrap metal and wood debris remaining at the mill site.

The waste rock dump is located south of the mill. The volume of the dump is approximately 2,300 m^3 .

The tailings are located south of the waste rock and are surrounded by dense trees. The area of the tailings is approximately 6,000 m^2 while the volume is about 50,000 m^3. There are numerous oxidation colours: red-orange-brown, yellow and chocolate brown. The distribution of colours is in a patchwork-like fashion. The weathering of the tailings is pervasive both aerially and with depth. The yellow colour may represent 'wash' as the tailings are a red-orange in the sub-surface. Water was pooling in areas of the tailings. This was not sampled. The tailings were sampled in one location.

Mine Drainage:

Stagnant drainage was present in the adit. Whether this water flows seasonally is unknown.

Also, water was pooling in areas of the tailings. This water was not sampled. No seeps were observed.

Observations & Analytical Results:

The stagnant water in the adit had a field pH=5.5 and a slightly metallic odour. The water was red from the Fe-ppt in the water. No vegetation was present in the water.

Water quality results from the stagnant water in the adit are: pH=5.4, [SO_4]=434 ppm, H=270 ppm. The sulphate concentration exceeds the water quality guidelines for aquatic life. Metals also in excess are Al, Cd, Co, Cu, Pb, Mn and Zn. Cd and Zn are especially elevated.

Photo 45. View of Camborne tailings from mill.

Photo 46. Camborne adit. The mine water was stagnant when sampled.

Photo 47. Camborne mill and tailings.

- Al is 1 order of magnitude greater than the water quality guidelines. The Al is primarily dissolved.
- Cd is 4 orders of magnitude higher than the water quality guidelines and is a dissolved species in the drainage.
- Co is 1 order of magnitude greater than the guidelines. The Co in the drainage is dissolved.
- Cu in the stagnant water is dissolved and resides as a dissolved species.
- Pb is 1 order of magnitude greater than the guidelines. The Pb species are both dissolved and colloidal in the drainage.
- Mn is slightly above the guidelines and is a dissolved species.
- Zn is 2 orders of magnitude greater than the guidelines and is present as a dissolved species.

See Appendix B for the geochemical data set.

Additional Comments:

Because the water sampled was stagnant, evaporation may have concentrated the metal content. Many of the metals in excess (Al, Cd, Co, Cu, Fe, Pb, Mn,) are dissolved species. Analyzing water at freshet when the water is flowing would provide a clearer picture of the geochemistry.

The tailings originate from various properties, including Goldfinch and Sunshine-Lardeau.

References: ***See*** **MINFILE**

JACKSON

Property name: JACKSON
Map number (*see* Appendix C): 38
Mine drainage sample numbers: LB00-3101 to 3106
MINFILE number: 082KSW015

Date: September 19, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny with a few clouds and cool

Regional Office: Cranbrook
NTS map sheet: 082K03E, 082F14E
Location: eastern extent of Jackson Basin, due west of Stenson Creek
UTM coordinates: stope at mill: 488470, 5538921; elevation: 1740 m. UTM coordinates for other workings are in the text.

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Zinc, Silver, Lead, Cadmium, Gold, Copper
Years mined (open/closed): 1894-1975

Mine Workings Inspected:

Mine components located include 4 adits, a stope, mill foundations and 4 waste rock dumps. The adits are situated one above the other with waste rock dumps in between. No tailings were found on site; they may have been disposed of in Stenson Creek. The historic site has an overprint of modern exploration (trenching and drilling).

The 1887 m adit #1, the uppermost adit, has coordinates of 488291, 5539048. The portal is timbered and is 70% blocked by slumped shaley rock containing fine grained, disseminated galena. The shale and overburden is naturally revegetating. The adit was dry.

The corresponding waste rock dump to the 1887 m adit is located directly down slope. The dump volume is approximately 700 m^3. Oxidation of the dump is minor.

The 1862 m adit is located at the 488353, 5538955 and is to the west of 1887 m waste rock dump. The portal is partially blocked by slumped rock. Water was draining from the portal and was sampled.

The corresponding waste rock dump (1862 m dump) has minor oxidation. The volume of the dump is on the order of 35,000 m^3.

The 1796 m adit is located beneath the 1862 m dump at 488353, 5338955. There was no drainage in this portal. The adit is partially blocked by slumped overburden as well as metal and wooden debris. Scrap metal (corrugated sheets, large metal pipe) is littered outside the adit. The adit rail tracks are still present.

The corresponding waste rock dump (1796 m dump) is located down slope from the adit. The dump wasn't inspected closely. The volume of the dump is on the order of 35,000 m^3 and the rocks have undergone minor oxidation.

The lower adit is located beneath the 1796 m dump. The UTM coordinates were not taken but the elevation is approximate 1770 m. The portal is inaccessible due to slumped waste rock blocking the portal. Other debris such as rusting barrels, rail tracks and rotting wood is also present at the portal. Drainage was coming from the portal and was sampled.

The lower waste rock dump (~1770 m) down slope has 2 small seeps, which were too minor to sample. Bright green, carpet-like moss is growing in the vicinity of these seeps. There was also minor iron precipitation at these localities. The dump has a volume on the order of 200,000 m^3.

Waste rock also surrounds the mill. The volume was not recorded.

Remains of the mill include old foundations, a heap of rotting wood and scrap, rusty metal. An old ore bin adjacent to the mill is standing, as was a small wooden cabin.

A flooded break through stope is located east of the mill, just above Stenson Creek at 488470, 5538921 and 1740 m elevation. The drainage was flowing into the creek but was not sampled.

Mine Drainage:

Drainage was flowing from the 1862 m adit and the 1770 m adit. The drainage in both cases infiltrated the overburden. The drainage from these adits was sampled.

Two small seeps were observed in the lower waste rock dump (~1770 m). The seeps were too minor to sample.

The drainage from the surfaced stope was draining into Stenson creek at a rate of ca. 20 L/min. The drainage was not sampled.

Observations & Analytical Results:

1. 1862 m adit

Drainage from the 1862 m adit was flowing at a rate of 1-2 L/min. The field pH=5.5 and conductivity 380 µs. The drainage was odourless and very cold. There were no visible precipitates or salts. Vegetation consisted of bright green, mat-like moss, which was growing in the flow.

Water quality analysis results for 1862 m adit are: pH=8.09, $[SO_4]$=106 ppm and H=260 ppm. The sulphate level is above the water quality guidelines for aquatic life but only by a minor fraction. The only elevated metal is Zn.

Photo 48. Jackson adit (elevation 1760 m). The drainage flowing from the adit is not visible in the photo.

- Zn concentration is above but of the same magnitude as the guidelines. The Zn in the drainage is dissolved.

2. Lower adit (~1770 m)

The drainage from the lower adit (~1770 m) was flowing at a rate of ~10 L/min. The pH=5.5 and conductivity 280 µs. There were no visible salts or precipitates and no odour. The water was sampled for geochemical analysis.

Water quality results are: pH=8.11, $[SO_4]$=74 ppm and H=194 ppm. Elevated metal concentrations above the water quality guidelines for aquatic life are Cd and Zn.

- Cd is 3 orders of magnitude above the guidelines. The degree of the dissolved component of Cd in the drainage is unknown as the dissolved concentration is below detection (<0.1 ppm).
- Zn is 1 order of magnitude greater than the guidelines. The Zn in the drainage is dissolved.

3. Break through stope

The drainage from the break through stope had a field pH=5.0 and conductivity 270 µs. The drainage flowed at a rate of approximately 20 L/min. No vegetation was present and the water had no discernible odour. The drainage was not sampled.

See Appendix B for the geochemical data set.

Additional Comments:

Zn and Co are the only metals which exceed the water quality guidelines for aquatic life. The scenario at Jackson appears to be one of alkaline rock drainage and related metal leaching. A possible source of zinc could be ZnO, a product of sphalerite weathering.

References: *See* MINFILE

LUCKY JIM

Property name: LUCKY JIM
Map number (*see* Appendix C): 39
Mine drainage sample numbers: n/a
MINFILE number: 082KSW023

Date: September 19, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny with a few clouds and cool

Regional Office: Cranbrook
NTS map sheet: 082K03E
Access: on Highway 31A, 6 km east of the Sandon-New Denver junction
UTM coordinates: 485149, 5542742; elevation: 1061 m

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Zinc, Silver, Lead, Cadmium, Gold, Tin
Years mined (open/closed): 1893-1959

Mine Workings Inspected:

The site was not inspected, as it is located on the other (south) side of Seaton Creek from the highway and the crossing was difficult. While on site, the name of the property was unknown.

The workings observed include deteriorating mill foundations, several portals, numerous waste dumps, tailings and an abandoned tram station 2.5 km west along the highway.

The tailings are in Seaton Creek but are probably not exclusively from the Lucky Jim mill. The tailings have a reddish colour. A beaver dam in Seaton Creek is immediately due west of the workings.

About 2.5 km west along Highway 31A is an abandoned tram station and dump material. The UTM coordinates are 483072, 5541524, elevation 955 m. The tram is also located south of the creek but the creek was passable. Tailings are still present in the creek at this location. An old mining road is situated above the tram. The old abandoned workings observed from the highway could not be located via this road.

Mine Drainage:

n/a

Additional Comments:

From the UTM coordinates taken (485149, 5542742, elevation 1061 m) the property was determined to be the MINFILE past producer Lucky Jim. MINFILE describes the site locations as located immediately southwest of Bear Lake and the historic mining community of Zincton. This description corresponds to an abandoned mine marked on NTS map 082K03 on the (reverted?) Crown Grant L.847.

References: *See* MINFILE

Photo 49. Dumps at Lucky Jim property. Drainage is visibly flowing over the middle dump.

SLOCAN SOVEREIGN

Property name: SLOCAN SOVEREIGN (L.1927)
Map number (*see* Appendix C): 40
Mine drainage sample numbers: LB00-3201 to 3203
MINFILE number: 082FNW036

Date: September 19, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny and warm

Regional Office: Cranbrook
NTS map sheet: 082F14E
Location: situated on Crown grant Lot 1927, on the north side of Carpenter Creek about 1.5 kilometres north of the community of Cody
Access: forest road north of Cody
UTM coordinates: upper portal - 485759, 5537007; elevation 1564 m.

Type of deposit: Polymetallic veins Ag-Pb-Zn±Au
Commodities mined: Lead, Silver, Zinc, Gold, Copper
Years mined (open/closed): 1898-1968

Mine Workings Inspected:

On site are a tram tower and relics, extensive waste rock dumps, numerous derelict buildings, 1 stope and 1 adit.

An open stope/drift is situated along the access path west of the road. There was no water draining from or in the opening. No visible oxidation was apparent.

The upper portal is situated west of the surfaced stope. Railroad tracks exit the portal and lead to a curved trestle, which is stable. Scrap wood is littered around the trestle. The portal is boarded but not locked providing easy access to the adit. Water was draining from the portal and was sampled.

A total of 8 waste rock dumps are located at various elevations on either side of the draw above the Slocan Sovereign workings. Most of the dumps are at higher elevations. The volume of the waste rock dumps was difficult to estimate as they were numerous, widespread and distant. An air photo may show the distribution of the dumps.

The lower portal was not inspected due to safety concerns. The portal appears to have a load out station (for the tram?), which is in a state of ruin. Drainage was flowing from the portal at ~ 70 L/min. From a distance, no obvious oxidation could be observed.

Mine Drainage:

Drainage was flowing from both the upper and lower portals. The drainage from both adits flowed into the valley. Carpenter Creek is the receiving water course.

Observations & Analytical Results:

The drainage from the upper portal was draining at a rate of ~ 60 L/min. The field pH=5.5 and conductivity= 340 µs. No visible precipitates or salts were present. Bright green, stringy, individual moss-like plants

Photo 50. Slocan Sovereign adit with flowing drainage.

were growing within the flow. The drainage had no discernible odour. Water samples were taken for analysis.

Analytical results of the water sampled from the upper portal are as follows: pH=8.09, $[SO_4]$=106 ppm and H=244 ppm. Zn is the only metal above the water quality guidelines for aquatic life.

- Zn is of the same order of magnitude as the guidelines, although the Zn in the drainage is dissolved.

See Appendix B for the geochemical data set.

Additional Comments:

At the time of the inspection, the name of the site was unknown. The location, access route and aspects of the MINFILE description of the Slocan Sovereign mine site all correspond to the inspection details.

The eight waste rock dumps reside on the workings of the Slocan Sovereign, Deadman (085FNW037) and American Boy (082FNW181) properties. It will be difficult to accurately assign the dumps to the appropriate mine site.

References: *See* MINFILE

RENO

Property name: RENO (L.12684)
Map number (*see* Appendix C): 41
Mine drainage sample numbers: LB00-3301 to 3303
MINFILE number: 082FSW036

Date: September 20, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: mostly overcast, with some sun and cool temperatures

Regional Office: Cranbrook
NTS map sheet: 082F03E
Location: on Reno mountain at the headwaters of Nugget Creek, a tributary of Sheep Creek
Access: Rough road up Sheep Creek and Reno mountain. The journey was time consuming and took the better part of the day.
UTM coordinates: upper portal - 490700, 5447893; elevation 1959 m

Type of deposit: Au-quartz veins
Commodities mined: Gold, Lead, Zinc, Silver, Copper, Mercury (1942 only)
Years mined (open/closed): 1906-1979

Mine Workings Inspected:

The upper portal is located at 490700, 5447893, elevation 1959 m. No drainage was flowing out of the collapsed portal.

The lower portal is accessible and was draining water at the time of the inspection. Tracks exit the portal and lead to a trestle above the road. The drainage was sampled. The UTM coordinates of the lower portal are 490510, 5447819, elevation: 1886 m. A collapsing wooden structure is outside of the portal

There are 3 waste rock dumps on site. With the exception of the dump below the lower portal, the waste rock dumps are weathered at the surface to an orange-brown colour.

Also on site are extensive mine ruins including ore bins and buildings. Many buildings are half collapsed although there are a few still standing. Scrap metal, pipes, barrels and wooden debris are strewn over the site.

The tailings were not located although there is documentation of an impoundment.

Photo 51. Waste rock dump, Reno mine site.

Photo 52. Lower adit. The drainage from the adit is being sampled.

Mine Drainage:

The drainage from the lower portal infiltrates an unoxidized area of a waste rock dump. The drainage resurfaces at the foot of the dump on the road. Its flow path is unknown beyond this point.

Observations & Analytical Results:

The drainage from the lower portal has a field pH = 50, conductivity =80 µs and the flow was ~ 15 L/min. The water had a slight metallic odour. Bright green mat-like moss was growing proximal to the flow. The water was sampled.

The water quality results are as follows: pH=8.09, $[SO_4]$=11 ppm and H=44 ppm. Zn is the only metal in excess of the water quality guidelines for aquatic life.

- Zn is dissolved in the drainage. Its concentration is 0.002 ppm above the water quality guidelines.

See Appendix B for the geochemical data set.

References: *See* MINFILE

UNKNOWN MILL NEAR SANDON

Property name: UNKNOWN MILL NEAR SANDON
Map number (*see* Appendix C): 42
Mine drainage sample numbers: n/a
MINFILE number: Unknown

Date: September 19, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny with clouds and cool

Regional Office: Cranbrook
NTS map sheet: 082F14E
Location: in the Cody area, south of Rico Mountain
Access: via the Carpenter Lake Forest Road from Sandon. The mill straddles the raod.
UTM coordinates: 486041, 5536288; elevation: 953 m

Type of deposit: n/a
Commodities mined: n/a
Years mined (open/closed): n/a

Mine Workings Onspected:

The mill is located on a hill slope and straddles Carpenter road; access is from above and below. A creek, a tributary of Carpenter creek, is at the foot of the property.

No equipment remains on site although the foundations remain. A few juvenile trees are growing within the confines of the foundation structure.

Various wooden mill buildings remain on site, including an ore bin, processing plant and a trestle. The ore bin and plant appear to be in good condition but the trestle is collapsing. Other unidentified, collapsed wooden structures are on site.

Ore is littered around the site containing fine grain, disseminate sulphides, including pyrite, galena and sphalerite.

No tailings were visible on site. They likely were disposed of in the adjacent creek.

Mine Drainage:

n/a

Additional Comments:

Given the location of the mill, the ore was likely transported to the mill and could have processed ore from more than one mine site. Two properties that are located close to the mill at higher elevations are Chambers (L.1752) and Number One (L.4560). MINFILE makes no reference to the fate of the ore from these properties and it is uncertain whether these properties are related to the mill.

References: *See* MINFILE

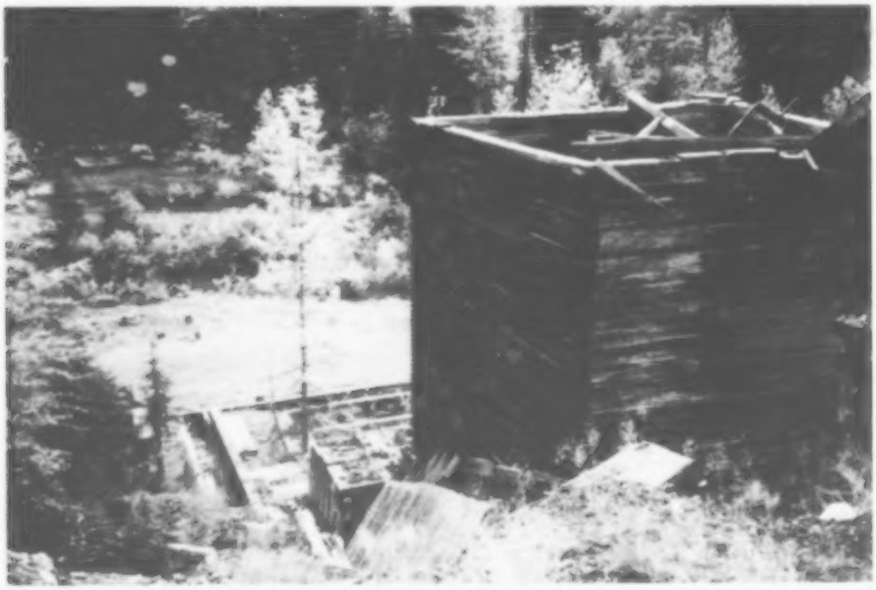


Photo 53. Unknown mill near Sandon, B.C. The mill could not be linked to specific mine sites.

UNKNOWN WORKINGS ON IDAHO PEAK

Property name: UNKNOWN WORKINGS ON IDAHO PEAK
Map number (*see* Appendix C): 43-45
Mine drainage sample numbers: n/a
MINFILE number: unknown

Date: September 19, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook), Gregg Stewart (Mining Division, Victoria) and L. Barazzuol (Mining Division, Victoria)
Weather: sunny and warm

Regional Office: Cranbrook
NTS map sheet: 082F14E
Location: Idaho peak, southwest of Sandon
Access: Idaho peak lookout road and environs
UTM coordinates: see specific workings

Type of deposit: n/a
Commodities mined: n/a
Years mined (open/closed): n/a

Mine Workings Inspected:

1. Unknown adit

An unknown adit was located on the Idaho Peak lookout road, including a partially collapsed mill. S. Wuschke noted that the tailings had previously been sampled. UTM coordinates: 480898, 5537557, elevation 1419 m. These workings could be part of the Queen Bess property (082FNW010).

2. Unknown waste rock dump and portal

Located on the Queen Bess Ltd. Road, the waste rock dump was dry with some minor oxidation. At the top of the dump was a collapsed portal. Both the portal and dump were dry. The UTM coordinates: 479909, 5537500; elevation 1689 m. The coordinates taken on site correlate with those of the MINFILE property Silverite (082FNW011).

3. Unknown adit

A partially collapsed portal with drainage was inspected. The pH of the drainage was 5.5 and conductivity 170µs. The flow was ~ 5 L/min and the drainage odourless. No oxidation was visible around the portal. A small waste rock dump was situated to the west of the portal. The UTM coordinates: 481630, 5536572; elevation 1316m. The workings could be part of the New Springfield (082FNW199) mine site.

Photo 54. Unknown adit on Idaho Peak, elevation 1419 m.

Photo 55. Uknown adit on Idaho Peak, elevation 1316 m.

References:

Possibly MINFILE Queen Bess (082FNW010), Silverite (082FNW011) and New Springfield (082FNW199)

UNKNOWN PORTAL NEAR KOOTENAY FLORENCE (082FNW016)

Property name: UNKNOWN PORTAL NEAR KOOTENAY FLORENCE

Map number (*see* Appendix C): 46
Mine drainage sample numbers: n/a
MINFILE number: unknown

Date: September 14, 2000
Persons present: Steve Wuschke (Mining Division, Cranbrook) and L. Barazzuol (Mining Division, Victoria)
Weather: hot and sunny

Regional Office: Cranbrook
NTS map sheet: 082FNW016
Location: Cedar Creek area/road to Cody Caves
Access: west of the road to Cody Caves, on the main forest road, which is unmarked
UTM coordinates: 505914, 5512001; elevation: 787 m

Type of deposit: unknown
Commodities mined: unknown
Years mined (open/closed): unknown

Mine Workings Inspected:

The portal had been backfilled with a culvert installed by Westmin/Boliden (S. Wuschke). Drainage was flowing from the portal. The forest licensee has placed a sign reading "domestic water" by the culvert. No precipitates or salts were visible.

A series of waste rock dumps are adjacent to the portal. The surface rocks of the dump are not visibly oxidized. The dumps were not inspected due to time constraints.

Mine Drainage:

n/a

UNKNOWN ADITS ON MONTE CRISTO MT., ROSSLAND, BC

Property name: UNKNOWN ADITS ON MONTE CRISTO MOUNTAIN, ROSSLAND B.C.
Map number (*see* Appendix C): 47-48
Mine drainage sample numbers: n/a
MINFILE number: unknown

Date: September 13, 2001
Persons present: Steve Wuschke (Mining Division, Cranbrook, Phil Johnson (Granite Mountain Excavating, Rossland) and L. Barazzuol (Mining Division, Victoria).

Weather: overcast and cloudy

Regional Office: Smithers
NTS map sheet: 082F04
Location: Rossland, BC
Access: outskirts of Rossland
UTM coordinates: *see* below

Type of deposit: unknown
Commodities: unknown
Years mined (open/closed): unknown

Mine Workings Inspected:

The names of the following portals could not be determined but are all located on Monte Cristo Mountain.

1. UTM coordinates: 0441519, 5437741

- elevation: 1231 m
- portal was backfilled by Granite Mountain Excavating. There was only a minute trickle of water draining from the portal which subsequently infiltrated the ground. The pH=5.5 and conductivity was 410µs. No water sample was taken for analysis. The water was odourless. Little vegetation is present due to the recent reclamation works.
- Prior to the excavation, the adit was flooded. When the reclamation work was performed, large volumes of creamy water flowed out (as reported by Phil Johnson). The creamy substance, possibly a clay, was still present on the ground although much of it had been washed away. Where it was present, it was approximately 3 cm thick. The kaolinite-like-substance was not sampled.

2. UTM coordinates: 0442066, 5437754

- located on the east side of Monte Cristo Mt.
- the portal entrance was driven ~west.
- the adit is possibly connected with the "Evening Star" workings.
- portal recently backfilled with a culvert installed. Work performed by Granite Mountain Excavating.

Photo 56. Unknown backfilled adit (UTM coordinates: 0441519, 5437741) on Monte Cristo Mountain., Rossland, B.C.

- film of oil/gas in water from heavy machinery.
- water flowed from the culvert at a rate of ~5 L/min. The flow diminished with distance and eventually infiltrates the ground.
- juvenile amphibians were present in the water.
- plant life within the drainage included green moss.
- pH=5.5; conductivity=410µs.
- the water was not sampled for analysis.

Mine Drainage:

n/a

References: Unknown

TAKLA SILVER (Lustdust)

Property name: TAKLA SILVER (LUSTDUST)
Map number (see Appendix C): 49
Mine drainage sample numbers: LB00-3401 to 3403
MINFILE number: 093N 009

Date: September 25, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: warm and sunny, slightly overcast

Regional Office: Prince George
NTS map sheet: 093N11W
Location: situated on a ridge west of the divide between Silver and West Kwanika creeks, approximately 35 kilometres east-northeast of Takla Landing
Access: The main camp is approximately 180 km northwest of Fort St. James, or 77 km west of Germansen Landing on Germansen Lake Road. Bralorne-Takla adits are about 3 km west of the camp.
UTM coordinates: n/a

Type of deposit: Polymetallic manto Ag-Pb-Zn
Commodities mined: Silver, Zinc, Lead, Gold, Antimony, Copper
Years mined (open/closed): unknown

Mine Workings Inspected:

Mine workings inspected include 2 backfilled adits and a waste rock dump.

Two collapsed/backfilled portals adjacent to each other were previously draining water (K. MacDonald). No culverts were in place. Only the north adit was draining at the time and was sampled.

The access road was built on top of the waste rock dump, west of the portals. The waste rock fizzes vigorously as the dump contains marble. The volume of the dump is ~800 m^3. The slope of the dump face is about 27 degrees. There was minor visible oxidation in the limestone and altered argillite members. Secondary minerals included limonite or goethite. No visible mineralization was observed. The edge of the dump was fractured and slumped. A high percentage (~75%) of the dump was comprised of fines and sediments.

Mine Drainage:

The drainage from the northern portal flowed east under the road, surfaced on the other side and then flowed down the waste rock dump into the surrounding forest.

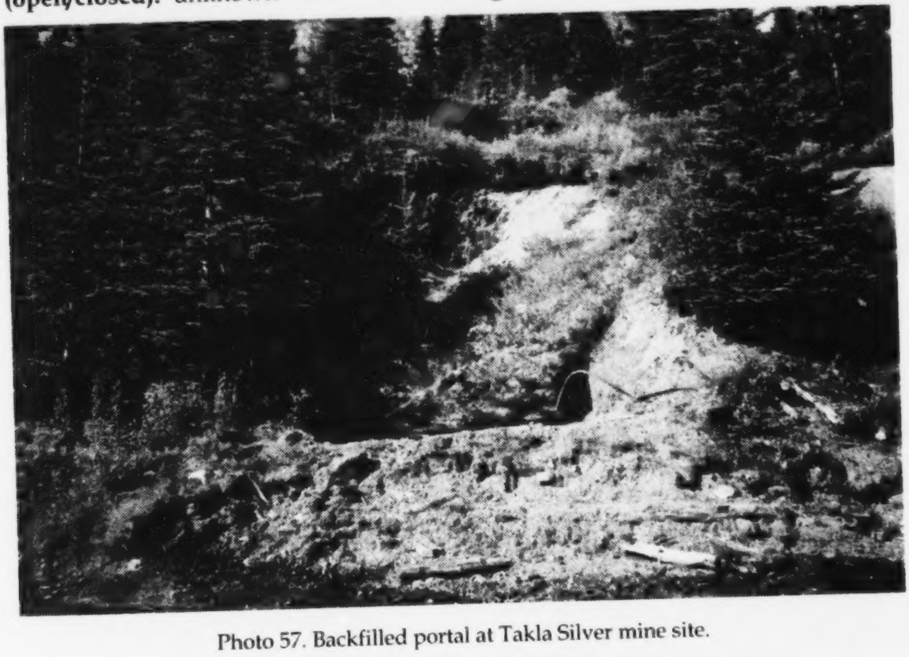


Photo 57. Backfilled portal at Takla Silver mine site.

Observations & Analytical Results:

The drainage from the northern portal flowed at ~5-8 L/min. The field pH=5.0. The water was odourless with no visible oxidants or salts. Bright and dark green moss was prolific in the drainage paths. The drainage was sampled.

Water quality analyses are as follows: pH=7.76, $[SO_4]$=55 ppm, H=228 ppm. Metals above the water quality guidelines for aquatic life are Sb, As, Fe and Zn.

- Sb is dissolved in the drainage and is 1 order of magnitude higher than the guidelines.
- As is colloidal in the drainage and is 1 order of magnitude greater than the guidelines.
- Fe in the drainage is colloidal and is 0.05 ppm above the water quality guidelines.
- Zn is of the same magnitude as the water quality guidelines. Only the dissolved fraction is in excess, by 0.25 ppm.

See Appendix B for the geochemical data set.

Additional Comments:

Although carbonate horizons could provide potential buffering capacity to the system, it appears acid generation is not active at this locale (slightly acidic field pH, neutral lab pH, low sulphate). However, metal leaching is a concern, especially the dissolved Sb and Zn in the drainage. The high concentration of Sb is probably related to the disseminations of lead antimonides in the siliceous and carbonaceous horizons (MINFILE).

The property currently has an MX permit. The exploration site is at a higher elevation than the workings described in this report.

References: *See* MINFILE

BRALORNE-TAKLA

Property name: BRALORNE-TAKLA
Map number (*see* Appendix C): 50
Mine drainage sample numbers: LB00-3501 to 3504
MINFILE number: 093N 008

Date: September 25, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Prince George
NTS map sheet: 093N11W
Location: near the divide between Silver and West Kwanika creeks, approximately 37 kilometres east-northeast of Takla Landing
Access: The main camp is approximately 180 km northwest of Fort St. James, or 77 km west of Germansen Landing on Germansen Lake Road. Bralorne-Takla is less than 1 km north of the camp.
UTM coordinates: n/a

Type of deposit: Almaden Hg
Commodities mined: Mercury
Years mined (open/closed): 1943-1944

Mine Workings Inspected:

Onsite the following was inspected: 1 shaft and headframe, waste rock dump, mill (smelter) site, various buildings and camp infrastructure as well as the calcine tailings.

An open shaft and headframe are located at the north end of the mill complex. The headframe above the main shaft has collapsed on top of the shaft opening. However, the headframe timbers are unstable and alone, pose a hazard to public safety. The shaft is flooded - the water surface is about a 4 second drop. The water from the shaft was sampled. Dump cars and scrap steel noted in area.

The waste rock dump, directly south of the shaft/headframe is comprised of 3 fingers. The dumps are largely composed of limestone and massive crystals of calcite. The rocks are sparsely oxidized in patches to a brown-orange colour. The collective volume of the dump is in the order of 1800 m^3

The former smelter is located south of the shaft. The foundation remains. Remnants of equipment include cooling tubes for mercury vapour condensation, a large rotary retort and a cinder brick-lined fire box. The kiln has been removed. Abundant timbers and scrap located at the mill site.

Various buildings and camp infrastructure remained on site:

- A large foundation, timbers and scrap from what is thought to be an old power house are located west of the shaft.
- Refuse was scattered around the entire mine site (rusting tins, hardened cement still in the bags, etc.).

Photo 58. Bralorne-Takla dump and shaft headframe.

Photo 59. Bralorne Takla mercury mill remains.

Photo 60. Bralorne Takla

- large concrete foundation due east of primary mine building. Scrap metal and timbers noted.

The calcine tailings, the byproduct of ore roasting, are situated south of the camp, across the road. The roasted tailings were deposited as an arcuate shaped dump. The eastern side of the dump is mostly comprised of coarse material (> 10cm) and fines where as the west dump is composed of silt-sized tailings. The surface of the dump appeared to be scattered with limestone, most of which has settled to the toe of the dump. The tailings were a brown-red colour. It appeared as if some of the material had been removed. Partial revegetation has occurred on the top and at the base. The volume of the dump is in the order of ~300 m^3. K. MacDonald suspects the tailings were also deposited in 2 small natural lakes nearby. The lakes have an unusual greenish colour. It was not determined if there were tailings in the lake.

Mine Drainage:

No surface drainage observed.

Observations & Analytical Results:

The analytical results of the water from the flooded shaft are as follows: pH=7.8, $[SO_4]$=7 ppm and H=211 ppm. Metal concentrations above the water quality guidelines for aquatic life include Fe, Hg and Zn.

- Fe exists as dissolved species as well as a colloid/precipitate in the water. The dissolved concentration of Fe is not in excess of the guidelines. The colloid/precipitate concentration is about 0.4 ppm above the guideline threshold concentration.
- Hg is above the guidelines for aquatic life (0 ppm) but below the guidelines for drinking water (1 ppm). The concentration of total Hg in the flooded shaft is 0.0015 ppm. The water was not analyzed for dissolved Hg.
- Zn is in excess of the guidelines but of the same magnitude. Zn in the drainage is both dissolved and as colloid/precipitates. Neither the dissolved or colloidal/precipitate fraction alone is above the guidelines.

See Appendix B for the geochemical data set.

Additional Comments:

The discharge/recharge of the water in the underground workings, and therefore the dispersion of the Hg in the subsurface, is unknown. The u/g workings are ~69,000 m^3 (MINFILE).

Up to 10% unrecovered Hg can be in the calcine tailings after ore processing (Rytuba and Klein, 1995). If there is relic Hg in these tailings, it may pose an environmental threat.

If the tailings contain Hg and were deposited in the lake, the Hg may undergo methlyation in the aqueous environment. Methylation produces a biologically toxic species of Hg.

References: *See* MINFILE

Rytuba, J.J. and Klein, D.P., 1995. Almaden Hg deposits. In: du Bray, Edward A., Preliminary compilation of descriptive geoenvironmental mineral deposit models. U.S. Geological Survey Open-File Report 95-831, p. 193-198.

SNOWBIRD

Property name: SNOWBIRD
Map number (*see* Appendix C): 51
Mine drainage sample numbers: LB00-3601 to 3603
MINFILE number: 093K 036

Date: September 26, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny, clear and cool

Regional Office: Prince George
NTS map sheet: 093K07E
Location: southwest shore of Stuart Lake
Access: 7 km rough access trail from the end of public road at Sowchea Bay public campground
UTM coordinates: n/a

Type of deposit: Au-quartz veins; Stibnite veins and disseminations
Commodities mined: Gold, Antimony
Years mined (open/closed): 1939-1953 (intermittently)

Mine Workings Inspected:

Three underground workings were observed, one of which was flooded. One waste rock dump is onsite.

The main adit measures 5′ by 7′. No drainage was present. Access to the underground is blocked by caved ground at about 3 m inside. The opening is partially closed by a roughly assembled plywood cap.

An inclined shaft is located about 50 m east of the main adit. The shaft is inclined at about 40 degrees and flooded to within 3 m of the collar. K. MacDonald has never observed surface drainage but there may be movement of water in the subsurface. The water was sampled for further analysis. Access inside the shaft is partially and ineffectively blocked with a roughly constructed timber cap. Conditions of the workings below waterline are unknown.

A third smaller opening is situated about 100 m east of the inclined shaft. The opening is inclined at 40 degrees and caved almost immediately inside the portal. Some broken timbers are inside.

A 25 m long waste rock dump, in the shape of a finger, is located south of the third, smaller opening. The volume of the waste rock dump is on the order of 1000 m^3 of material. The dump is partially vegetated. A few pieces of scrap timber are scattered around the workings.

Mine Drainage:

No surface drainage observed. Subsurface drainage of flooded decline is unknown.

Observations & Analytical Results:

The flooded inclined shaft had a field pH=6.0. The water was odourless. No visible precipitates in the water sample. Observations were difficult as the

Photo 61.Northern portal at Snowbird mine containing a collapsed decline.

opening to the decline was partially blocked by timbers.

Water quality results are as follows: pH=7.84, $[SO_4]$=492 ppm and hardness=1173 ppm.

- the chemical breakdown of ankerite is likely buffering the acid in the system, as indicated by the high hardness value.
- SO_4 is above the water quality guidelines for aquatic life. The concentration is high, indicating that acid is being produced.
- the system has buffering capacity as indicated by the field and lab pH.

Metals in excess of the water quality guidelines for aquatic life include As, Fe and Mn.

- As in the drainage is likely colloidal. The dissolved concentration is below detection (<0.2 ppm) so the speciation cannot be determined. As is 1 order of magnitude above the guidelines. The source of the elevated As may be from the weathering of the arsenopyrite (MINFILE).
- Fe is 1 order of magnitude higher than the water quality guidelines. The Fe is likely a colloidal/particulate species. Although the dissolved concentration is below detection (<0.03 ppm), the total concentration is 2 orders of magnitude higher, implying a large proportion of the Fe is colloidal/particulate. Potential sources of Fe, given the mineralogy, include ankerite, arsenopyrite and pyrite.
- Mn is mostly in the dissolved form. The dissolved (and total) concentration is slightly above the water quality guidelines. The mobile, aqueous species of manganese is Mn^{2+} which is stable in a reducing/acidic environment.

See Appendix B for the geochemical data set.

Additional Comments:

The operation was small scale (MINFILE production was ~48 tonnes).

References: *See* MINFILE

QUESNEL QUARTZ

Property name: QUESNEL QUARTZ
Map number (*see* Appendix C): 52
Mine drainage sample numbers: n/a
MINFILE number: 093G015

Date: September 26, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).

Weather: sunny and warm

Regional Office: Prince George
NTS map sheet: 093G07E
Location: 4 km east of Hixon off Hwy. 97.
Access: from Hixon, 2 km along Hixon Creek Road, then 2 km on the old mine access.
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities mined: Gold, Silver
Years mined (open/closed): 1932, 1939

Mine Workings Inspected:

This site has undergone some reclamation. An old ore bin was pulled down and a shaft sealed.

At the site of the former ore bin, ore was scattered (massive quartz with disseminated and veinlets of pyrite). A concrete mill foundation and wooden debris were also onsite.

The shaft was sealed and covered. The shaft before it was sealed was recorded as flooded.

Despite having a old map of the mine site, no workings, other than those noted above, were located. Hixon Creek shifted course about 5 years ago, making it difficult to reference the workings on the historical map. There was also a heavy overprint of contemporary placer activity in the area. Placer dumps were numerous and may be covering workings. Workings labeled on the map which weren't located include the waste rock dump, 2 of the 3 shafts and 2 adits. The area is well vegetated with no visible signs of oxidation.

Mine Drainage:

n/a

Additional Comments:

n/a

References: *See* MINFILE

Property File 093G015 (maps in this file)

Photo 62. Site of former ore bin. Note ore and wooden debris scattered on ground.

CARIBOO THOMPSON

Property name: CARIBOO THOMPSON
Map number (*see* Appendix C): 53
Mine drainage sample numbers: n/a
MINFILE number: 093A091

Date: September 27, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Prince George
Location: Penny Creek near its confluence with Peter Gulch Creek on Yanks Peak. The site is located near the Snowmobile Club house.

Access: From Wells/Barkerville, 14km east on 3100 Road; right at the cross road for 8 km and then right on the Yank Peaks Road.
UTM coordinates: n/a
Type of deposit: Au-quartz veins
Commodities mined: Gold, Silver, Lead, Zinc, Tungsten
Years mined (open/closed): 1937 only

Mine Workings Inspected:

Only one adit was located on the site, which was open and accessible but appeared to be in stable condition. The phyllitic rocks around the collar were weathered an orange-brown colour. Water was draining from the adit but was not sampled.

The waste rock dump was adjacent to the portal to the south. The waste rock was composed of two small adjacent dumps with a collective volume in the order of 100 m^3. Visible mineralization included disseminated and massive pyrite. Lithologies include massive quartz vein material and phyllite. The rocks were weathered to a orange-brown colour.

East of the portal was an open cut and dump that were probably a result of exploratory work. Exposed was an undeveloped quartz vein.

Mine Drainage:

The drainage flowed through the waste rock dump and towards Penny Creek.

Observations & Analytical Results:

The drainage from the adit flowed at a rate of ~2-3 L/min. The field pH was 5.0-5.5 and the conductivity 350 µs. A dark orange-brown Fe-ppt was present as was sparse grass-like vegetation. The water was odourless.

The drainage was not sampled due to budget constraints. As the drainage at three other mines with similar geology on Yanks Peak were sampled (Jim (093A037), Jane (093A027) and Cariboo Hudson (93A071)), drainage sampling at Cariboo Thompson was not performed.

Additional Comments:

The property inspected may not be Cariboo Thompson as determined by MINFILE. K. MacDonald and B. Lane's (Mining Division, Prince George) findings from their current investigations of the past producers in the Wells/Barkerville area show that this may be a deposit not listed in MINFILE. An accurate identification will be determined at a later date.

References: *See* MINFILE

Holland, Stuart S., 1954. Geology of the Yanks Peak-Roundtop Mountain Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 34, 102 pages.

Photo 63. Cariboo Thompson adit.

CARIBOO HUDSON

Property name: CARIBOO HUDSON
Map number (*see* Appendix C): 54
Mine drainage sample numbers: LB00-3801, LB00-3802, 3804
MINFILE number: 093A071

Date: September 27, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Prince George
NTS map sheet: 093A14W
Location: north side of Pearce Gulch, 29 km from Barkerville. Centred on Crown Grant lot 9816.
Access: From Wells/Barkerville, 14km east on 3100 Road; right at the cross road for 8 km and then right on the Yank Peaks Road for approximately 5 km. The last 5 km were on rough road and was accessed by ATV.
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities mined: Gold, Silver, Lead, Zinc, Tungsten

Years mined (open/closed): 1938-1939

Mine Workings Inspected:

The Cariboo Hudson workings are the most extensive on Yank's Peak. The site is comprised of 1 adit, waste rock dumps, mill remnants and numerous other building ruins. No tailings were observed. Given the proximity of Pearce Gulch to the mill, the tailings were likely flushed down the gulch.

The adit on Pearce Gulch (known as the 200 level adit) was the main entry to the mine. The portal is located within an open cut, of which the eastern flank has slumped, leaving uprooted trees in front of the portal. There is no access to the adit as it has been backfilled. The timbers forming the collar appear relatively new. Water is covering the floor of the adit. No apparent oxidation or precipitation exists within or around the adit. Water is draining from the adit and was sampled.

The waste rock dump has partially revegetated with shrubs, moss and immature trees. The dumps are primarily composed of phyllites and schists (~90%). Quartz vein material containing veinlets of mineralization and disseminated pyrite comprise ~1-2% of the dump. The dump is locally weathered to a dark red-brown colour. En masse, the dump appears unweathered as only ~5% of the total dump is oxidized. The volume of the dump is in the order of 1000 m^3.

The remnants of the 100 tonne cyanide mill include dilapidated buildings are and concrete foundations. Approximately 15 other ruined buildings and sheds are in the area. Many are collapsed and those that are still standing are unstable. Wooden debris is littered over the site.

Mine Drainage:

The drainage from the adit flows for 100 m on the surface before it merges with Pearce Gulch a tributary of Pearce Creek. Pearce Gulch flows through the waste rock dump.

Photo 64. Cariboo Hudson adit. Note drainage in foreground.

Observations & Analytical Results:

The drainage from the portal was flowing at a rate of ~ 2-3 L/min. No visible salts or precipitates are within the drainage. The water is odourless with a pH of 5.0 and a conductivity of 80 µs. Dark green-black moss is growing within the flow. The drainage flows into a semi-stagnant pool where an oily film is on the water surface. The water was sampled and analyzed.

Water quality results are as follows: pH=8.19, $[SO_4]$=5 ppm and H=67.54 ppm. All metal concentrations are within compliance with the BC water quality guidelines for aquatic life.

ML/ARD is not occurring at this site. This is consistent with the other mines sampled on Yanks Peak (Jane, Midas and Jim).

See Appendix B for the geochemical data set.

Additional Comments:

Two other portals, one on Simlock Gulch and the other on the "Fourth of July" claim are documented. K. MacDonald, Inspector of Mines - Prince George, has never located these portals.

References: *See* MINFILE

Holland, Stuart S., 1954. Geology of the Yanks Peak-Roundtop Mountain Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 34, 102 pages.

Property File 093A0715.4.7 Jim

JIM

Map number (*see* Appendix C): 55
Mine drainage sample numbers: LB00-3901 to 3903
MINFILE number: 093A037

Date: September 27, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Prince George
NTS map sheet: 093A14W
Location: on Luce Crk, northeast of Yanks Peak, centred on Crown Granted Lot 4681
Access: From Wells/Barkerville, 14km east on 3100 Road; right at the cross road for 8 km and then right on the Yank Peaks Road for approximately 12 km. The last 12 km were on rough road and accessible by ATV.
UTM coordinates: 606811, 5857797

Type of deposit: Au-quartz veins
Commodities mined: Gold, Silver, Lead, Zinc
Years mined (open/closed): no record

Mine Workings Inspected:

The one portal on site was located at the end of an open cut. The timbered collar was standing but the adit roof had failed. Access was blocked by the collapsed roof rock. The wallrock contained carbonates and was composed of fissile phyllite, schists and quartzites. There was no visible oxidation in outcrop. Water was trickling from the adit and was sampled.

To the east of the portal was a 3 fingered waste rock dump. Oxidation of the dump was minor. Visible sulphides include disseminated pyrite in sericitic schistose rocks and disseminated pyrite in quartz vein material. In both lithologies, the sulphides comprised <1% of the rock. Oxidation of the pyrite in the quartz was evident as it was weathering to a brown-orange colour. The lithologies of the dump don't contain carbonate minerals as the rocks didn't fizz with HCl application. The total volume of the 3 fingered dump is in the order of 1000 m^3.

Buildings, both standing and collapsed were onsite. Rusting equipment and rotting wood were present at the toe of the dump. A loading chute for ore was still standing.

Mine Drainage:

The drainage infiltrated the overburden.

Observations & Analytical Results:

The drainage from the adit was flowing at a rate of ~1 L/min. The drainage was odourless with a pH=5.0 and conductivity=110 µs. No vegetation, visible precipitates or salts were present.

The water quality results are as follows: pH=8.03, [SO$_4$]=14 ppm and H=98.6 ppm. No metals were in excess of the water quality guidelines for aquatic life.

See Appendix B for the geochemical data set.

Additional Comments:

ML/ARD is likely not occurring at this site. This is consistent with the other mines sampled on Yanks Peak (Jane, Midas and Cariboo Hudson).

Safety hazards are a concern at this site. The area is frequented by snowmobilers.

MINFILE property status is listed as "showing." This status does not reflect the extent of disturbance on site.

References: *See* MINFILE

Holland, Stuart S., 1954. Geology of the Yanks Peak-Roundtop Mountain Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 34, 102 pages.

Photo 65.Open cut leading to an adit at the Jim property.

JANE (Snowshoe)

Property name: JANE (SNOWSHOE)
Map number (*see* Appendix C): 56
Mine drainage sample numbers: LB00-4001 to 4003
MINFILE number: 093A027, 093A030

Date: September 27, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Prince George
NTS map sheet: 093A14W
Location: on Yanks Peak, near the headwaters of Luce Creek
Access: From Wells/Barkerville, 14km east on 3100 Road; right at the cross road for 8 km and then right on the Yank Peaks Road for approximately 13 km. The last 13 km were on rough road and was accessed by ATV.
UTM coordinates: 605917, 5857399

Type of deposit: Au-quartz veins
Commodities mined: Gold, Silver, Lead
Years mined (open/closed): no record

Mine Workings Inspected:

Two adits and a waste rock dump were inspected. All the workings were located along the road.

The first, uppermost adit, known as the Camp adit, had collapsed or was backfilled with oxidized rocks. Drainage was flowing from the portal. The water was sampled after it had merged with the drainage from the lower adit.

Two small waste rock dumps were situated on the south side of the road from the Camp adit. Some minor oxidation was visible. The dumps are partially revegetated. The volume of the dumps was in the order of 50 m^3.

The lower adit, known as the Intermediate adit, was about 10 m south of the upper portal. The opening was accessible although very hazardous. The portal timbers were unstable as were the shale/phyllite rocks comprising the roof. Drainage was flowing from the adit. The water merged with that from the Camp adit. A composite of the drainages was sampled.

A small waste rock dump was adjacent to the Intermediate adit. It was slightly oxidized and was revegetated on the lower slope with brush and immature trees. Visible sulphides included disseminated pyrite in phyllite, massive pyrite in quartz as well as ankerite. The volume of the dump was on the order of 250 m^3.

A derelict shack was located at the hairpin turn in the road. The shack is still standing but its stability is questionable.

Mine Drainage:

The upper portal drainage flowed over the road, down the lower waste rock dump and then merged

Photo 66. Lower portal at the Jane (Snowshoe) mine site. Note upper adit drainage path at the base of the bank and the hut at the road hairpin.

with the drainage from the lower portal. A sample of the collective drainage was sampled.

Observations & Analytical Results:

Water was draining from the upper portal at a rate of ~2-3 L/min. The pH=5.0 and conductivity =70 µs. The water was odourless with no visible precipitates or salts. No vegetation was present.

The drainage from the lower portal was flowing at a rate of ~2-3 L/min, with a pH=5.0 and conductivity = 160 µs. There were no visible salts or precipitates observed. The water was odourless and dark green hair-like moss was growing in the drainage.

Water quality results are as follows: pH=8.13, $[SO_4]$=9 ppm, H=70.98 ppm. The metal concentrations were all below the water quality guidelines for aquatic life.

ML/ARD is not occurring at this site. This is consistent with the other mines sampled on Yanks Peak (Jim, Midas and Cariboo Hudson).

See Appendix B for the geochemical data set.

Additional Comments:

Property also referred to as Snowshoe Gold mine.

MINFILE property status is listed as "showing." This status does not reflect the degree of disturbance on site.

The literature indicates a series of buildings once stood on the property as well as 5 adits.

References: *See* MINFILE

Holland, Stuart S., 1954. Geology of the Yanks Peak-Roundtop Mountain Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 34, 102 pages.

MIDAS

Property name: MIDAS (L. 4670)
Map number (*see* Appendix C): 57
Mine drainage sample numbers: LB00-4101 to 4103
MINFILE number: 093A035, (093A033)

Date: September 27, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Prince George
NTS map sheet: 093A14W
Location: east of the apex of Yank's Peak on Crown Granted Lots 4670, 4671, 4673 and 4674. Situated on the ridge separating French Snowshoe and Little Snowshoe Creeks. Directly east of Saddle (093A033).
Access: From Wells/Barkerville, 14km east on 3100 Road; right at the cross road for 8 km and then right on the Yank Peaks Road for approximately 15 km. The last 15 km were on rough road and was accessed by ATV.
UTM coordinates: n/a

Photo 67. Midas adit and drainage.

Type of deposit: Au-quartz veins
Commodities mined: Gold, Silver, Lead, Zinc
Years mined (open/closed): 1949

Mine Workings Inspected:

The main adit is located on the Midas property. The adit is partially blocked/ caved and has been for some time given the established state of the vegetation on the slumped material. Access into the adit is possible but it was flooded and draining water at the time of the inspection. The water was sampled.

According to Bulletin 34 (Stewart, 1954), the purpose of drilling within the adit was to explore the extent of the quartz veining on the property. Access is potentially a health and safety hazard.

Down slope or west of the main portal lies two waste rock dumps.

The larger dump rises to a height of about 18 m and is composed of phyllites and schists. Although the dump is rich in sulphides, in general there is very little observable oxidation. Disseminated sulphides (1-10%) are weathered to a dark-brown red. The dump was partially revegetated on the top.

The smaller dump is comprised of mainly quartz vein containing massive pyrite weathered to a dark-brown red. This dump also has very little visible oxidation despite its high sulphide content. The dump was partially revegetated on the top.

A collapsed building surrounded by wood and metal debris was at the mouth of the portal. This may have been a part of the old mill that was documented in the Minister's Annual Reports. No mill foundations were observed.

Fifty tonnes of test ore from the adjacent Jim property was milled at the Midas property with uneconomic recovery (Stewart, 1954). No tailings were observed on site and the location of the mill, reported to exist, was not found. The tailings may have been flushed down Luce creek.

Mine Drainage:

The drainage from the main adit infiltrates the adjacent waste rock dump, resurfaces at the dump toe and proceeds to drain into Luce Creek.

Observations & Analytical Results:

The drainage from the main adit was flowing at a rate of ~3-5 L/min into a bright green mossy area. No visible precipitates or salts were observed. The pH=5.0 and conductivity=200 μs. The water was odourless. The drainage was sampled for further chemical analysis.

The water quality results are as follows: pH=8.1, $[SO_4]$=27 ppm and H=191 ppm. All of the metal concentrations measured were below the threshold values of the BC water quality guidelines for aquatic life.

ML/ARD does not appear to be occurring at this site. This is consistent with the other mines sampled on Yanks Peak (Midas, Jim and Jane).

See Appendix B for the geochemical data set.

References: *See* MINFILE

Holland, Stuart S., 1954. Geology of the Yanks Peak-Roundtop Mountain Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 34, 102 pages.

Minister's Annual Reports: 1929-C194; 1933-A137; 1934-C30; 1949-A103; 1950-107

WARSPITE

Property name: WARSPITE
Map number (*see* Appendix C): 58
Mine drainage sample numbers: LB00-4201 to 4203
MINFILE number: 093H048

Date: September 28, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and cool

Regional Office: Prince George
NTS map sheet: 093H03W
Location: On Proserpine Mountain, west of the confluence of McCallums Gulch and Williams Creek. Crown Granted lot 9560.
Access: approximately 6.5 km along rough road up Conklin Gulch. Trailhead is from east side of Barkerville, across Williams Creek. ATV access.
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities: Gold, Silver, Lead, Iron
Years mined (open/closed): no record

Mine Workings Inspected:

Two adits, a series of waste rock dumps and a shaft were located and inspected.

The lower adit was located in an open cut along the north side of the access road. The rocks in the open cut were weathered to the same orange-brown colour as the waste rock dump. The portal was timbered and a wooden door provided secure closure to the adit. Red drainage flowing from the adit was sampled.

The lower waste rock dump was adjacent to the lower adit, on the south side of the road. The dump appeared to have been terraced, as it was level. The overall area of the dump was on the order of 200 m^2 with a volume of ~4,000 m^3. Visible sulphides included disseminated pyrite in quartz, disseminated galena and chalcopyrite in argillite/phyllite and 2% disseminated pyrite in a feldspar porphyry. The dump was weathered in patches to an orange-brown colour. Pockets of grass and shrubs were growing on the dump. The southern toe of the dump appeared to have been recently recontoured and thus hosted no vegetation. The drainage flowed over the dump.

The upper adit is located about 20 m east and 20 m above the lower adit. The portal is accessible by a small road from the main road. The portal is timbered and the adit accessible. Immediately inside, the adit is partially caved. No water or drainage was observed in or flowing from the adit.

The upper waste rock is not contained in one dump but rather distributed in various piles adjacent to the upper portal. An estimate of the waste rock was difficult as much of the dump material has been revegetated, the rock is scattered in various piles and the rock forms the base of the road, which is now covered in vegetation. The area of waste rock disposal was approximately 250 m^2. The visible waste rock had spotty weathering of an orange-brown colour. Most of the sulphide weathering was within the quartz. No sulphides were visible. Red drainage was seeping from one of the dumps on the east side of the secondary access road, near the main road.

The Warspite shaft is located approximately 350 metres east of the upper adit. The shaft is located within a collapsed log cabin. The collar of the shaft had collapsed and wooden debris was strewn over top and within. Access was possible to the unflooded shaft. The shaft presents a potential health and safety threat. Waste rock was scattered around the vicinity of the cabin. The only visible sulphide was pyrite hosted in the quartz vein material. The pyrite was weathered to a brown-red colour. The piles of waste rock had naturally regenerated with juvenile trees, shrubs and grasses with the exception of those dump areas rich in quartz.

Between the shaft and the adits were a number of collapsed wooden shacks and buildings.

Mine Drainage:

The lower adit drainage flowed over the road and waste rock dump and into the adjacent forest. The Fe precipitate in the water was still evident below the waste rock dump. McCallums Gulch, which is a tributary of Williams Creek, is the receiving watercourse.

Red drainage is seeping from upper waste rock dump.

Observations & Analytical Results:

1. Lower adit

The red drainage from the lower adit was flowing at a rate of approximately 10-15 L/min. The drainage field pH = 5.0 and conductivity 220 µs. The drainage smelled stagnant. The water was laden with Fe-precipitate. The only signs of vegetation were algal mats, which appeared to grow on/with the Fe-precipitate. The drainage was sampled.

The water quality results are as follows: pH=8.1, [SO_4]=40 ppm and H=161 ppm.

- the system is not acid generating, as implied by the low SO_4 concentration.

Metals in excess include Fe, Mn and Zn.

- Fe is 1 order of magnitude greater than the water quality guidelines. The dissolved concentration is below detection (<0.03 ppm). Given the high content of Fe precipitate in the drainage, the Fe is likely to be mostly precipitate. The mineralogy of the deposit includes arsenopyrite and pyrite (MINFILE), 2 possible sources of Fe.

Photo 68. Drainage, heavy in iron precipitate flowing from the Warspite lower adit.

- Mn is of the same order of magnitude as the water quality guidelines. The Mn species in the drainage are both dissolved and colloidal/particulate.

- Zn is slightly above the threshold value set by the water quality guidelines. Only a small fraction of the Zn in the drainage is dissolved, it mostly resides as colloids and/or particulates. The weathering of sphalerite in the deposit (MINFILE) may be the source of the Zn in the drainage.

2. Upper waste rock dump seep

The waste rock dump seep was rich in Fe-precipitates and flowed at about 2 L/min. The field pH=5.0 and conductivity =180 µs. The drainage supported a prolific, green mat-like spongy moss as well as red stringy moss. An oily film was on the surface of the water. This drainage was not sampled due to low flow.

Metal leaching not acid rock drainage is an issue at Warspite.

See Appendix B for the geochemical data set.

Additional Comments:

MINFILE property status is listed as "showing." This status does not reflect the degree of disturbance on site.

Related properties are Proserpine (093H021), Independence (093H051) and Hard Cash (093H052), all of which are MINFILE showings in the vicinity.

References: *See* MINFILE

Sutherland Brown, A., 1957. Geology of the Antler Creek Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 38, 103 pages.

Property File 093H048

CANUSA

Property name: CANUSA
Map number (*see* Appendix C): 59
Mine drainage sample numbers: n/a
MINFILE number: 093H 058

Date: September 28, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and cool

Regional Office: Prince George
NTS map sheet: 093H04E
Location: Stouts Gulch, west of Barkerville
Access: short branching trail leading south from the main access road which runs the length of Stout's Gulch. ATV access.
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities: Gold, Lead, Zinc, Bismuth
Years mined (open/closed): 1946-1948

Mine Workings Inspected:

Flooded shaft with collapsed headframe is onsite. The headframe has collapsed over the opening obstructing entry, although access is still possible.

Waste rock dump comprised of argillite and quartz is situated immediately adjacent to the shaft. Its dimensions are 80 m long by 15 m wide at the toe tapering to 2 wide at the crest. The volume is in the order of 8,000 tonnes. The crest is partially vegetated. Scrap steel is at the toe of the dump.

Five wooden buildings onsite. Main building is still standing while the others are in a state of disrepair.

Mine Drainage:

No surface drainage noted.

Additional Comments:

MINFILE property status is listed as "showing." This status does not reflect the degree of disturbance on site.

References: *See* MINFILE

Sutherland Brown, A., 1957. Geology of the Antler Creek Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 38, 103 pages.

Photo 69. The shaft headframe and buildings (one is collapsed in the foreground) at Canusa mine site.

ISLAND MOUNTAIN

Property name: ISLAND MOUNTAIN
Map number (*see* Appendix C): 60
Mine drainage sample numbers: LB00-4301 to 4306
MINFILE number: 093H006

Date: September 29, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: rainy and cool

Regional Office: Prince George
NTS map sheet: 093H04E
Location: southeast face of Island Mountain.
Access: from Wells
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities: Gold, Silver, Lead, Zinc, Tungsten, Bismuth
Years mined (open/closed): 1934-1954

Mine Workings Inspected:

Workings inspected include a main waste rock dump, 2 draining portals, 1 collapsed shaft, a flooded and caved opening and 1 ventilation house.

The main waste rock dump is located along the northwest side of the highway and has an approximate volume of 100,000 m^3. The dump contains phyllite hosting disseminated pyrite weathered to an orange-brown colour. Some of the phyllite contains carbonate. Quartz vein material containing massive pyrite is also present. Overall, the entire dump appears unoxidized although there are localized, sparse patches of pyritic weathering.

The main 4000 haulage portal is located on top of the dump. The adit was gated and inaccessible. Drainage was flowing south from the adit. The drainage was sampled.

Located 75 m southwest of the main 4000 haulage portal, along a footpath, was a unstable and open collared shaft. A fence with a warning sign surrounds the opening. It was not determined if the shaft was flooded.

Located about 50 m southwest of the shaft, along the same footpath, was a flooded and caved opening. The timbers were rotten and have failed. The type of opening could not be determined although tracks were coming from it. Scrap wood and metal littered the area. The water draining from the underground working was heavy in red iron precipitate and was not sampled.

Southwest of the flooded and caved opening, along the same footpath was an adit with a small building directly outside of the portal. This building is possibly a fan house. A chain link fence blocks access to the adit. Large volumes of water, laden with iron precipitate, were draining from the adit. The drainage was sampled. No dump was visible down slope. K. MacDonald postulates this opening may be a flooded ventilation shaft.

No evidence of mill infrastructure.

Mine Drainage:

Drainage from the main portal flowed south into a ditch. The drainage infiltrated the ground in the ditch.

The caved opening located between the 2 draining adits was flooded and draining water high in iron precipitate. The water was trickling into a small pond of water with an oily film on the surface. The water was not sampled.

The water draining from the adit with a small building at the portal, flowed through and around the small building and southeast down the slope toward the highway. The red, iron precipitate laden water flowed into a flooded ditch along the northwest side of the highway and to a culvert linking the ditch to Willow River. The end of the culvert draining into

Photo 70. Red drainage flowing from the pump house at Island Mountain.

Photo 71. Island Mountain waste rock dump.

Willow River was not located. Highway 26 was under construction during summer/fall 2000. The culvert outflow may have been blocked during construction.

All 3 workings with drainage are at the same elevation.

Observations & Analytical Results:

1. Main production portal

Drainage was flowing from the main production portal at a rate of ~30 L/min. The pH=5.0 and conductivity 310 µs. The water was clear and odourless. Horsetails and shrubs were proximal to the flow but no vegetation was within the stream of the flow. The water was sampled at this location.

The water quality results are as follows: pH=8.17, $[SO_4]$=45 ppm and H=250 ppm. No metals are in excess of the BC water quality guidelines for aquatic life.

2. Adit with fan house

An estimate of the flow rate of the drainage from the adit with the fan house was difficult given the large and variable area of the flow path. A ballpark rate is ~20 L/min. The drainage was anomalously warm, heavily concentrated in red iron precipitate and had a strong iron odour. Deposition of the Fe-precipitate was >10cm in places. The pH=5.5 and conductivity 1450 µs. No vegetation was present in the water but the drainage flows through a well vegetated area. Samples were taken for further geochemical analysis.

The water quality results are as follows: pH=7.52, $[SO_4]$=1060 ppm, hardness=1296 ppm.

- the system is generating acid as indicated by the high sulphate concentration.
- carbonates, as indicated by the high value of hardness, are present in the system and provide buffering capacity.

Metals in excess of the BC water quality guidelines for aquatic life include Fe and Mn.

- Fe is 2 orders of magnitude greater than the water quality guidelines. However, the dissolved concentration is below detection limits (<0.03 ppm) implying the Fe in the drainage is colloidal and/or a precipitate. This is validated by the heavy iron precipitate observed in the drainage.
- Mn is slightly above the water quality guidelines and is dissolved in the drainage.

See Appendix B for the geochemical data set.

Additional Comments:

The property is adjoined to the north and east by the Mosquito (093H010) and Cariboo (093H019) groups (Cariboo Gold Quartz property).

Water sampling by International Wayside Gold is ongoing due to their application for mine development on nearby Cow Mountain.

References: *See* MINFILE

Sutherland Brown, A., 1957. Geology of the Antler Creek Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 38, 103 pages.

CARIBOO GOLD QUARTZ

Property name: CARIBOO GOLD QUARTZ
Map number (*see* Appendix C): 61
Mine drainage sample numbers: LB00-4401 to 4403
MINFILE number: 093H019

Date: September 29, 2000
Persons present: Ken MacDonald (Mining Division, Prince George) and L. Barazzuol (Mining Division, Victoria).
Weather: overcast and rainy

Regional Office: Prince George
NTS map sheet: 093H04E
Location: north spur of Cow Mountain, Lowhee Creek, and the westerly slopes of Barkerville Mountain.
Access: from Wells, across Lowhee Creek.
UTM coordinates: n/a

Type of deposit: Au-quartz veins
Commodities: Gold, Silver, Tungsten, Bismuth, Lead, Zinc
Years mined (open/closed): 1902-1967

Mine Workings Inspected:

The main haulage 1500 level adit is located on the top of the waste rock dump. The portal is collared with cement and is gated, making it inaccessible. A strong draft was blowing out of the adit. Water was flowing to the west from the adit at ~5 L/min, toward Jack of Clubs Lake. The water was sampled.

Southwest of the portal is the foundation of the former mill. Structural steel, cinder blocks and scrap metal litter the site. A wooden water tank remains standing, about 100 m west of the mill building.

The waste rock dump contained spotty oxidation of red-orange and yellow-green colourate. The dump was primarily comprised of phyllite containing 1-2% of disseminated pyrite. Other lithologies include quartz vein material and argillite. A fine fraction was also present but this component did not appear oxidized. The top of the dump was naturally revegetated with shrubs, spruce and various grasses. The dump face was too steep to sustain plants. The volume of the dump was ~500,000 m^3. There is a massive scrap heap of rusted equipment (mill steel, tanks, etc.) at the toe of the dump.

The tailings extend from the waste rock dump to the northeast shore of Jack of Clubs Lake. Tailings on site are estimated to be 2.9 million tonnes. About 60% of the tailings have naturally revegetated with grasses. Of the non-vegetated areas, about 70% is oxidized orange-brown. Lowhee Creek flows through the tailings and into the northeast end of Jack of Clubs Lake. Jack of Clubs Lake drains from the northeast and forms the headwaters of Willow River. The banks of the headwaters are composed of eroded tailings. Those that are subaqueous are oxidized an orange-brown colour. Drainage resurfaces on the tailings about 25 m southwest of the dump toe and flows into Jack of Clubs Lake. The source of this drainage is unknown but may be the 1500 level adit.

On the east side of the tailings are deteriorating foundations that may have been a powerhouse. Several ruined wooden buildings are in the general vicinity.

The BC Vein workings, part of the historic Cariboo Gold Quartz workings located at the head of Lowhee Creek, is the target of an exploration drill program by

Photo 72. Cariboo Gold Quartz tailings. Note the corner of the mill foundation in the foreground.

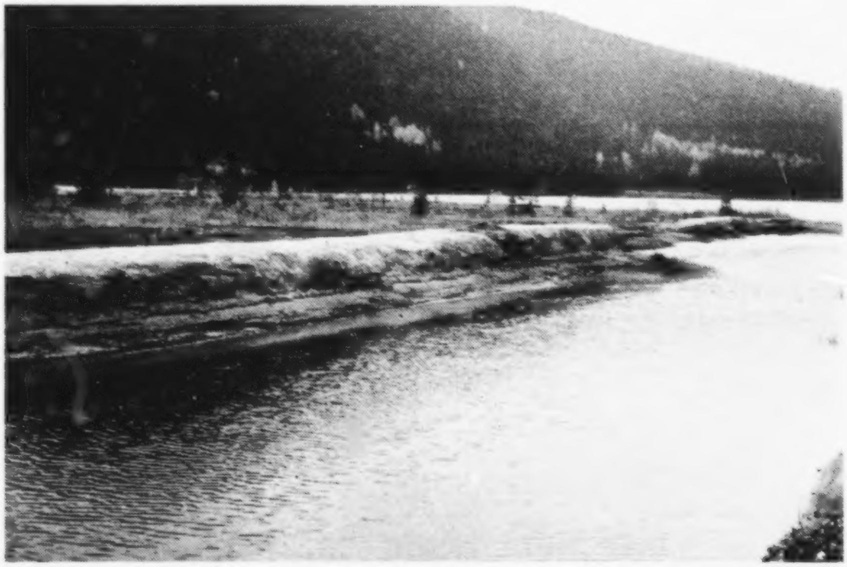


Photo 73. The Cariboo Gold Quartz tailings are submerged in Jack of Clubs Lake and the Willow River. Note the oxidized tailings along the bank of the Willow River.

International Wayside Gold Mines Ltd. Reclamation works performed by International Wayside include the capping of the BC shaft and removal of the headframe. Waste dump onsite is in the order of 3,500 tonnes. No drainage noted onsite.

Mine Drainage:

Drainage from the 1500 level portal was flowing to the west from the adit, toward Jack of Clubs Lake. The flow proceeded to the edge of the waste rock dump where it infiltrated the rocks. An ephemeral drainage path to the north also was present but no water was currently flowing in that direction.

Lowhee Creek flows through the tailings and into the northeast end of Jack of Clubs Lake. The Jack of Clubs Lake drains from the northeast and forms the headwaters of Willow River.

Observations & Analytical Results:

The drainage from the 1500 level portal was flowing at ~5 L/min. The pH=5.0 and conductivity 410 µs. The drainage contained red Fe-precipitates and had a strong iron smell. The drainage was sampled for further analysis.

Water quality results are as follows: pH=8.01, $[SO_4]$=225 ppm and hardness=327 ppm. Metals in excess of the water quality guidelines include Fe (colloidal/particulate) and Mn (dissolved and colloidal).

- Fe is 2 orders of magnitude greater than the water quality guidelines. However, the dissolved concentration is below detection limits (<0.03 ppm) implying the Fe in the drainage is colloidal and/or a precipitate. This is validated by the heavy iron precipitate observed in the drainage.
- Mn is slightly above the water quality guidelines and is both dissolved and colloidal/particulate in the drainage.

See Appendix B for the geochemical data set.

Additional Comments:

Water sampling by International Wayside Gold Ltd. is ongoing due to their application for a mine development certificate (Environmental Assessment Process) on nearby Cow Mountain (pers. comm. K. MacDonald, Inspector of Mines - Prince George).

The mine workings extend southeasterly from the north end of Jack of Clubs Lake through Cow Mountain to the Cariboo claim (Lot 93) at the head of Lowhee Creek, a distance of 3 kilometres.

References: *See* MINFILE

Azcue, J.M., Mudroch, A., Rosa, F., Hall, G.E.M., Jackson, T.A. and Reynoldson, T., 1995. Trace elements in water, sediments, porewater and biota polluted by tailings from an abandoned gold mine in British Columbia, Canada. Journal of Geochemical Exploration, 52, 25-34.

Sutherland Brown, A., 1957. Geology of the Antler Creek Area, Cariboo District. British Columbia. British Columbia Department of Mines, Bulletin No. 38, 103 pages.

NANAIMO REGION

LENORA

Property name: LENORA (L.35G)
Map number (*see* Appendix C): 62
Mine drainage sample numbers: LB00-4501 to 4506
MINFILE number: 092B001, *see* also 092B002 and 092B003

Date: June 30, 2000/ November 23, 2000
Persons present: Gregg Stewart, Diane Howe and L. Barazzuol (Mining Division, Victoria) / G. Stewart and L. Barazzuol (Mining Division, Victoria) and Greg Carriere (Mining Division, Nanaimo).
Weather: sunny and warm / sunny and warm, raining in morning before inspection

Regional Office: Nanaimo
NTS map sheet: 092B13W
Location: Mount Sicker
UTM coordinates: 442014, 5412923; elevation ~450 m.

Type of deposit: Noranda/Kuroko massive sulphide Cu-Pb-Zn
Commodities: Copper, Gold, Silver, Lead, Zinc, Cadmium, Barite
Years mined (open/closed): intermittently between 1898-1964

Mine Workings Inspected:

1. June 30, 2000

The waste rock dump trends SW-NE and is located on on the foot of a hill. It is primarily composed of fines and is heavily oxidized in patches to orange, red and brown. The volume of the dump is approximately 3,000 m^3. The dump is used as a playground for motor bikes and mountain bikes(?). The seepage from the toe of the dump was sampled.

Above the dump was a small adit. It was driven directly into the rock without a collar. The adit appears stable and is not gated.

2. November 23, 2000

It was the first time it had rained recently as winter 2000/01 has been very dry. The purpose for our return trip was to recollect the water samples of the creek and seep at the main waste dump and inspect workings that weren't located in June.

A 1,000 m^3 prismatic ore stockpile is located on the road northwest of the waste rock dump. The waste rock is primarily fines and is oxidizing to an orange colour. At the toe along the road is a sluice box/water diversion channel in disrepair. The pH=6.0. The source of this water is unknown.

West of the ore pile along the road are the remnants of a pump station which supplied water to the mine. On site are some large tanks and a concrete foundation and retaining walls.

On the western extent of the road is the tailings pond. The area is ~240 m^2 with an estimated volume of 500 m^3. The tailings are flanked by a clear cut forest block to the west. The tailings are very oxidized in patches to a bright orange colour. The tailings were sampled. A channel has been cut through the tailings by water, exposing the strata. The fate of the eroded tailings is likely out the spillway to lower elevations in the forest. The spillway is located on the western end and is clogged with wooden debris.

Mine Drainage:

Main waste dump contains seeps at the toe. The seep was sampled.

A creek runs alongside of the dump. The creek was sampled although the source of this water is unknown. The mine is in the Nugget Creek watershed, which flows into the Chemainus River (Copper Canyon).

No water was present at the time of the inspection.

Observations & Analytical Results:

1. Stream flanking waste dump

June 30, 2000 - A stream flows along the southwest edge of the dump. The flow rate was ~30 L/min, pH=5.6, conductivity=90 µs and sulphate = <50 ppm.

November 23, 2000 - The stream running along the southwest side of the dump was flowing at a rate of ~20 L/min, slower than in June. The pH=5.0. The water was clear and odourless. No vegetation was growing within the water. Samples were taken for further geochemical analyses. The approximate coordinates for the sample sites is 442014, 5412923, elevation ~450 m.

The geochemical results from the stream water are: pH=7.52, [SO_4]=9 ppm and H= 29 ppm. Elevated metals above the BC water quality guidelines for aquatic life include Cu (primarily dissolved) and Zn (primarily dissolved).

- Cu is 1 order of magnitude greater than the water quality guidelines. The Cu in the drainage is dissolved.

- Zn is 1 order of magnitude higher than the water quality guidelines. The Zn is dissolved in the drainage.

2. Waste dump seep

June 30, 2000 - The dump was seeping at the southwest toe. The field pH = 5.1, the conductivity = 800 µs and the sulphate = >200 ppm. The seep was sampled but not analyzed. Lichen was growing in the area of the seep. White precipitates/salts were also noted.

November 23, 2000 - A test pit was dug in at the southwest toe of the waste rock dump to collect seepage. Although seepage was present, water was flowing through the dump at a slower rate than in the summer (it took a few minutes to fill the pit). The pH=4.0. Green, red and brown lichen was growing in the seepage areas. The seep water was very turbid and odourless. The seep was sampled for further geochemical analyses.

The geochemical results are as follows: pH=4.75, [SO_4]=470 ppm and H=372 ppm.

- dump is acid generating as indicated by the pH and sulphate concentration, although there are carbonates buffering the system.

Metals in excess of the BC water quality guidelines for aquatic life are Al (both dissolved and colloidal fractions), Cd (primarily dissolved), Cr (colloidal) Co (dissolved), Cu (dissolved), Fe (colloidal), Pb (primarily total), Mn (primarily dissolved), Ag (colloidal) and Zn (primarily dissolved).

- Dissolved Al and colloidal/particulate Al are 2 and 3 orders of magnitude above the water quality guidelines respectively.
- Cd is 4 orders of magnitude above the water quality threshold concentration. Cd is dissolved in the seep.
- Cr is 1 order of magnitude above the water quality guidelines. Cr is colloidal/particulate in the seep.
- Co is 1 order of magnitude above the water quality guidelines. Co is dissolved in the seep.
- Cu is 3 orders of magnitude above the water quality guidelines. The Cu is of dissolved species in the seep.
- Fe is 2 orders of magnitude above the water quality guidelines. Fe is colloidal/particulate in the seep.
- Pb is 1 order of magnitude greater than the guidelines. The Pb in the seep is primarily colloidal/particulate.
- Mn is dissolved in the seep and is slightly above water quality guidelines.
- Ag is 2 orders of magnitude above the guidelines. Ag in the seep is colloidal/particulate.
- Zn is 2 orders of magnitude above the guidelines. The Zn in the seep are dissolved species.

The dump is ML/ARD. The high concentrations of metals may reflect the first fall rainfall event of the season, which may flush salts from the dump.

Photo 74. Lenora waste rock dump. The drainage flowing over the dump and seeps was sampled.

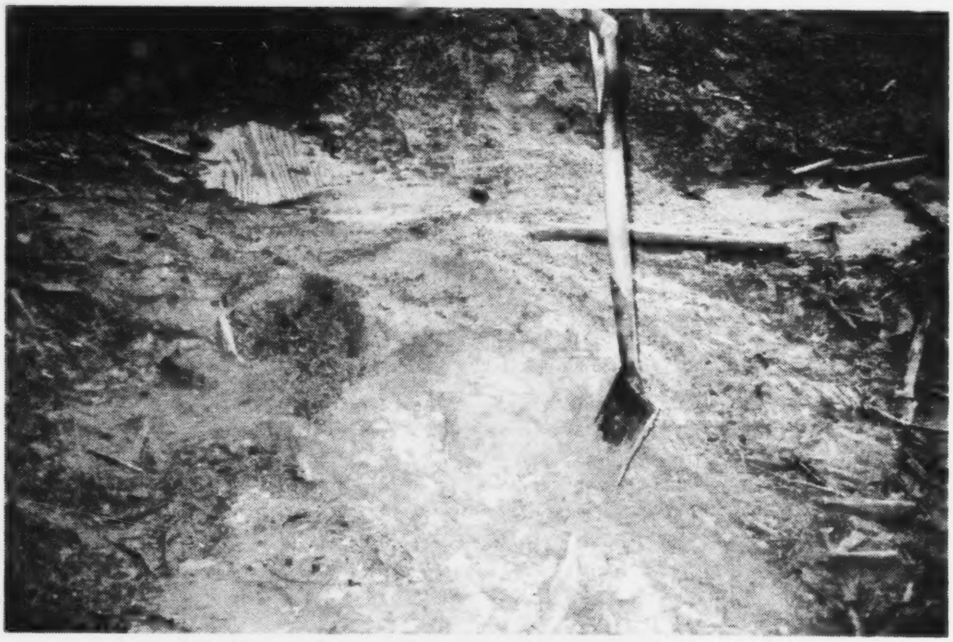


Photo 75. Oxidized subsurface of the Lenora tailings.

See Appendix B for the geochemical data set.

Additional Comments:

ML/ARD is a concern for the waste dump. The drainage flowing over the dump is high in dissolved Cu and Zn. The dump is seeping dissolved Al, Cd, Co, Cu, Mn and Zn. The drainage was sampled on the first heavy rainfall of the season.

Further studies warranted.

The Tyee workings are directly east of the Lenora workings on Mount Sicker.

References: *See* MINFILE

TYEE

Property name: TYEE (L.36G)
Map number (*see* Appendix C): 63
Mine drainage sample numbers: n/a
MINFILE number: 092B002, *see* also 092B001 and 092B003

Date: June 30, 2000
Persons present: Gregg Stewart, Diane Howe and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Nanaimo
NTS map sheet: 92B13W
Location: Mount Sicker, centred on Crown Granted Lot 36G
Access: Mount Prevost road from Hwy. 18
UTM coordinates: n/a

Type of deposit: Noranda/Kuroko massive sulphide Cu-Pb-Zn
Commodities: Copper, Gold, Silver, Zinc, Lead, Cadmium, Barite
Years mined (open/closed): 1901-1909

Photo 76. Tyee waste rock dump.

Mine Workings Inspected:

The two waste rock dumps are composed of waste rock and fines. The dump comprised of barite; schist containing disseminated chalcopyrite and calcite; and quartz with disseminate chalcopyrite. Secondary malachite and rusty red-brown oxidation are present. Immature trees are growing on the top and on the lower reaches of the slope. Scrap metal embedded in the dump.

Remnants of building, including bricks and wooden debris are littered on site.

A fenced off shaft with collapsed headframe was on site.

Mine Drainage:

No surface drainage observed.

Additional Comments:

The Tyee workings are directly east of the Lenora workings on Mount Sicker.

References: *See* MINFILE

RICHARD III

Property name: RICHARD III (L.39G)
Map number (*see* Appendix C): 64
Mine drainage sample numbers: n/a
MINFILE number: 092B003, *see* also 092B001 and 092B002

Date: June 30, 2001
Persons present: Gregg Stewart, Diane Howe and L. Barazzuol (Mining Division, Victoria).
Weather: sunny and warm

Regional Office: Nanaimo
NTS map sheet: 092B13W
Location: Mount Sicker, centred on Crown Granted Lot 39G
UTM coordinates: n/a

Type of deposit: Noranda/Kuroko massive sulphide Cu-Pb-Zn
Commodities: Copper, Gold, Silver, Lead, Zinc, Cadmium, Barite
Years mined (open/closed): 1903-1904, 1907

Photo 77. Richard III open shaft.

Mine Workings Inspected:

One collapsed and camouflaged shaft was located at the junction of 2 rough roads. The opening was partially fenced off but still accessible. Exploration drill holes are present in the vicinity. It could not be determined whether the shaft was flooded.

Mine Drainage:

None observed.

Additional Comments:

Small scale site – only 4,903 tonnes of ore mined.

References: *See* MINFILE

BLUE GROUSE

Property name: BLUE GROUSE (L.32,L.33)
Map number (*see* Appendix C): 65
Mine drainage sample numbers: n/a
MINFILE number: 092C017

Date: November 23, 2000
Persons present: Gregg Stewart and L. Barazzuol (Mining Division, Victoria), Gregg Carriere (Mining Division, Nanaimo) and two representatives from Timberwest
Weather: pouring rain and cool

Regional Office: Nanaimo
NTS map sheet: 092C16E
Location: south side of Cowichan Lake, 4.8 kilometres northeast of Honeymoon Bay
Access:. Access roadsfrom the south or north (mill) side
UTM coordinates: n/a

Type of deposit: Cu skarn
Commodities: Copper, Silver, Gold, Zinc
Years mined (open/closed): 1917-60

Mine Workings Inspected:

Numerous surface opening onsite, including the "Amphitheatre" (caved stope) and the "G" stope. Two portals were on site, of which the 1100 level was accessible. G. Carriere was collaborating with Timberwest, the surface owners and permitees of the E&N Land Grant, to address health and safety issues.

The old mill site contains garbage, scrap wood and metal. Concrete foundations and a small amount of ore are on site. Water of field pH=5.5 is running under and through the mill site. The source of this water is unknown, and therefore was not sampled.

The waste rock dump is located beneath the 1100 level opening, which served as the ore haulage level. The dump did not exhibit visible oxidation. It is comprised of silicified volcanics containing epidote and no sulphide mineralization. No vegetation is growing on the face of the dump although juvenile and mature trees, lichen and moss are vegetating the top. The estimated volume of the two tiered dump is approximately 2,000 m^3. At the foot of the dump is garbage.

The tailings are distributed into 3 separate ponds: the upper, middle and lower. The upper pond contains the original tailings impoundment. Successive erosion has created the bottom two tailing impoundments.

In the upper pond, preferential layering of the tailings causes drainage to flow toward the centre, the location of erosion and the source area for the lower ponds. The eroded gulley is approximately 1.5 m deep and is supporting juvenile trees in the vicinity. The tailings are pervasively oxidized to a red-brown colour containing minor malachite. Where water is pooling on the tailings, it is red. The area is used as a BMX bike course, particularly on the outside edges and in the eroded gulley. A sample of the tailings was taken. UTM coordinates of the upper tailings are: 410972, 5410778, elev'n: 349 m. The area of the tailings is approximately 100 m by 300 m.

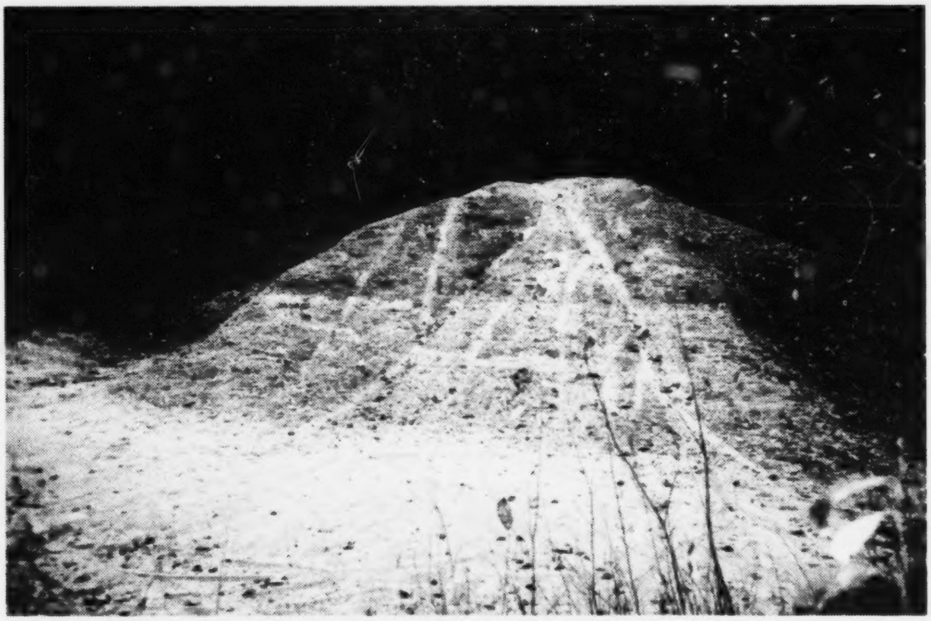


Photo 78. Blue Grouse upper tailings facility.

Photo 79. Blue Grouse upper tailings test pit.

The middle tailings are sand sized and are slightly oxidized in a localized area (2 m^2) at the upper end, proximal to the upper pond. The depth profile of oxidation was: 0-15 cm oxidized, 15-25 cm unoxidized, 25-32 cm oxidized, >32 cm unoxidized. Overall, the tailings appear unoxidized, likely due to the washing and rinsing during transport. The middle pond has also undergone erosion, leaving a series of mound shaped structures. The area and volume of the tailings is approximately 200 m^2 and 300 m^3 respectively.

The lower tailings are located along the road and have been deposited in a channel. The tailings appear unoxidized.

Mine Drainage:

Surface drainage entrains and transports tailings.

Surface drainage was observed at mill although the source of this water is unknown.

Additional Comments:

The site has a number of health and safety issues related to openings. Tailings pose potential environmental problems.

References: *See* MINFILE

- of Fisheries and Oceans. WLAP and MABC have viewed the Historic Mine Sites project presentation.
- Another field season of site inspections will better position the Ministry to develop an accurate list of high priority historic sites.

CONCLUSIONS AND RECOMMENDATIONS

The documentation and characterization of historic mine sites in British Columbia remains largely incomplete. The preliminary scoping of historic mine sites undertaken for this project, although rudimentary, has provided the Ministry of Energy and Mines a starting point in better understanding the issue. The work of this project also provides a basis by which future programs can be developed in an efficient and practical manner.

The concerns with historic mine sites principally relate to environmental degradation and public health and safety issues. Environmental issues include mining disturbances that have resulted in impacts to water quality from metal contaminated effluent. Health and safety issues include mine workings that pose threats to the public and include open shafts, adits, unstable ground and other mine infrastructure such as old buildings, structures and equipment.

Based on the water quality results coupled with the mine inspections, the following sites have been identified as having the greatest potential for environmental impacts. Follow up field investigations are warranted to comprehensively characterize these sites and potential off site impacts as candidates for future remediation.

- **Midway (082GSW021)** - Metal leaching and acid drainage concerns, including the two oxidized waste rock dumps and the drainage from the two adits. The lower adit drainage flows through the lower dump, which is an additional contributor to the ML/ARD.
- **Lenora (092B 001)** - Metal leaching and acid rock drainage is a major concern for the waste rock dump, as indicated by the geochemical seep sampling. Also, the tailings are strongly oxidized in patches and have been eroded and transported from the tailings facility.
- **Bralorne-Takla (093N 008)** - Concerns of mercury contamination in soil on site, particularly in the area surrounding the processing mill. Unprocessed mercury remaining in the calcine tailings may also be a potential environmental problem. The shaft is accessible and contains water with mercury concentrations above the BC Water Quality Guidelines for aquatic life but below the Guidelines for drinking water.
- **Ymir tailings (082FSW067-68)** - This highly oxidized tailings impoundment is located on the east bank of the Salmo River. Geochemical results indicate there is a high potential for metal release from the tailings in addition to the concern over the tailings washing down the Salmo River.
- **Second Relief (082FSW187)** - Alkaline rock drainage and metal leaching are issues at this site. The chemical interactions between the drainage and the dumps and tailings are the source of elevated metal concentrations, not the direct adit drainage. The tailings are strongly and pervasively oxidized. Solid mercury, a relic of the early 20th century gold recovery process employed on site, has been found near the mill site.
- **Sultana(093M061)** - Although this historic mine site is remote and small (approximately 600 m^2), water quality results indicate there are metal leaching and acid rock drainage issues on site. The waste rock is pervasively and strongly oxidized and warrants metal leaching and acid rock drainage characterization.

RECOMMENDATIONS

- Another method for prioritizing the scale of an operation, which was not employed in the 2000 field program, is basing inspections around known historical tailings impoundments. A map, "Historical Tailings Disposal Locations" (Eaton and Fournier, 2000) depicts all known tailings impoundments in the province. Tailings are indicative of metal concentration activities and may also contain contaminants introduced in the milling process.
- Conclusions identify priority sites for follow up field inspections. The priority for future field work, however, is to continue characterizing historic mine sites that have not had preliminary inspections.
- An alternative approach to ML/ARD investigations taken in the 2000 field season is to study historic mine sites on a watershed basis. This approach is being employed throughout the United States as it is considered to be the most cost effective and efficient method in terms of reclamation and remediation (Buxton et. al, 1997; Norman, 2000). This approach can be applied here in British Columbia in watersheds with a high density of historic mining activity, such as the Sheep Creek watershed in the Kootenays region. A GIS system would be essential in mapping the various attributes of the watershed (geology, water samples, mine components, TRIM map sheet data, the Geological Survey Branch's Regional Geochemistry Survey (RGS) data, etc.).
- Historic mine sites situated in community watersheds should have priority in terms of inspections, as they pose a direct threat to human health and safety. A GIS would be essential in determining these sites.

- The Ministry of Water, Land and Air Protection (WLAP) has a rating of the sensitivity of watercourses. This data would be a beneficial addition to the Historic Mine Sites Database. A GIS system would be a necessary tool in assessing historic mine site locations that are proximal to these high risk watercourses.

- Exploration for new ore bodies often occurs in the vicinity of historic mining camps. Exploration companies are proprietors of water quality data for some historic mine sites, as they have analyzed the adit drainage to determine if it could be used for drinking water (pers. comm., D. Alldrick, 2001).

- As the overall aim of the Historic Mine Sites project is prioritizing mine sites requiring remedial works, standardized, quantitative methods should be employed when inspecting sites. The creation of a field inspection form, which addresses the various components and hazards on site, is recommended. The form would standardize the information collected as well as facilitate data entry into the Historic Mine Sites Database. Integral to the form would be a ranking system assessing the types of risks (environmental, human health and safety etc.). A ranking system would provide a quantitative method of prioritizing sites for reclamation as well as create a standard in which inspections performed by different people can be compared and assessed.

- Site accessibility was the primary constraint in site selection; many sites were excluded, as they required specialized modes of transport, such as helicopters or ATV motorbikes. In some cases, such as the Reno property in the Kootenays, the sites were accessible by truck but the traveling was time consuming and took the better part of the day. An expanded field budget is crucial if the issue of historic mines is to be approached thoroughly and systematically.

- It is crucial to maintain the ML/ARD analytical budget. The analytical results of the mine drainage provide a quantitative measure of the ML/ARD and are a necessity to the project. However, not all mine sites had drainage or alternatively, the waste rock dump or tailings facilities appeared to have ML/ARD concerns. The analytical program should include provisions for analyses of tailings and waste rock dump material, so that these components can also be assessed for ML/ARD quantitatively.

- The Mining Division's Mines Inspectors as well as the Geologists from the Geological Survey Branch are potentially proximal to historic mine sites during the course of their inspections and field work. Provided a standardized field form and ranking system are in place, these people could assist in the inventorying of historic mine sites in BC. Kits containing supplies for water sampling and physical parameter tests (pH paper etc.) would be required.

- Collaborate with other agencies. The nature of the project is multi-disciplined. Other agencies with potential roles in this project include the Ministry of Water, Land and Air Protection (WLAP), the Mining Association of British Columbia (MABC), Environment Canada and the Federal Department of Fisheries. MELP and MABC have viewed the Historic Mine Sites project presentation.

- Another field season of site inspections will better position the ministry to develop an accurate list of high priority historic sites.

REFERENCES

Buxton, H.T., Nimick, D.A., von Guerard, P., Church, S.E., Frazier, A.G., Gray, J.R., Lipin, B.R., March, S.P., Woodward, D.F., Kimball, B.A., Finger, S.E., Ischinger, L.S., Fordham, J.C., Power, M.S., Bunck, C.M., and Jones, J.W., 1997. A Science-Based Strategy to Support Effective Remediation of Abandoned Mine Lands. Fourth International Conference on Acid Rock Drainage (ICARD) May 30-June 6, 1997, Vancouver, British Columbia, Canada.

Eaton, T and Fournier, M., 2000. Historical Tailings Disposal Locations. Mines Branch, Ministry of Energy and Mines, unpublished map.

Ministry of Energy and Mines, 1997. Health, Safety and Reclamation Code for Mines in British Columbia. Mines Branch, Ministry of Energy and Mines (formerly known as Regional Operations, Health and Safety Branch, Ministry of Employment and Investment), Victoria, B.C.

Ministry of Environment, Lands and Parks, 1998. British Columbia Water Quality Guidelines (Criteria): 1998 Edition. Water Quality Section, Water Management Branch, Environment and Resource Management Department, Ministry of Environment, Lands and Parks, Victoria, B.C.

Norman, David K., 2000. Washington's Inactive and Abandoned Metal Mine Inventory and Database. Washington Geology, v. 28, no. 1/2, p. 16-18.

APPENDIX A
BRITISH COLUMBIA WATER QUALITY GUIDELINES

	Contaminated Sites		BCWQC and Guidelines*		
Substance	Aquatic Life	Drinking water	Aquatic Life	Drinking water	
aluminum	50 @ pH<5 70@ pH5-5.5 110@ pH5.5<6 200@ pH6<6.4 500@ pH>6.4	200	22@ pH<5 29@ pH-5.5 47@ pH 6 74@ pH 6.4 100@ pH>6.5	200	AC
antimony	300	n/a	20	14	WC
arsenic	500	25	50		WC
barium	10000	1000	5000	1000	WC
cadmium	2@H<60 8@H60-<120 13@H120-<180 18@H>180	5	0.01@H<30 0.03@H90 0.05@H150 0.06@H210	5	WC
chromium	20	50	1 if Cr(VI) 9 if Cr(III)		WC
cobalt	500		1		
copper	20 @H<50 30 @ H50-75 40@ H75-100 50 @H100-125 60 @H125-150 70@H150-175 80@H175-200 90@H>200	1000	6.7 @ H<50 9 @ H 75 11.4 @H 100 13.8 @H 125 16.1 @H 150 18.5 @H 175 20.8 @H 200	500	AC
WAD cyanide	50		10		AC
iron	3000	300	300		WC
lead	40@H<60 50@H50-100 60@H100-200 110@H200-300 160@N>300	10	3 @H<8 34 @ H 50 82 @ H 100 197 @ H 200 330 @H 300	50	AC
manganese	1000	50	100 to 1000		WC
mercury	1	1	0	1	AC
molybdenum	10000	250	2000	250	AC
nickel	250@H<60 650@H60-120 1100@H120-180 1500@H>180	n/a	25 @H<60 65 @H60-120 110 @H120-180 150 @H>180		WC
selenium	10	10	1		WC
silver	1		0.1H<100 0.3 H>100		AC
sulphate	1000000	500	100000		WC
zinc	300	5000	33 @ H<90 40 @ H 100 115 @ H 200 190 @ H 300 265 @ H 400	5000	AC

**All values
are Total ug/L
AC =
approved
working
criteria based

APPENDIX B
WATER QUALITY DATA

The analytical results from the historic mine sites mine drainage sampling are organized according to Regional Office and are in the following order:

Smithers
Kamloops
Cranbrook
Prince George
Nanaimo

SMITHERS REGION

MINE SITE NAME	**BIG ONION**		**CRONIN**				**RED ROSE**		**ROCHER DEBOULE**	
Date (yy mm dd)	00 08 14		00 08 14				00 08 15		00 08 15	
Sample type	Adit drainage		Adit drainage		stream		Adit drainage		Stream adjacent to mill	
pH	4.11		7.37		7.41		7.11		7.48	
SO4 (ppm)	215		24		4		405		19	
Hardness (ppm)	138.77		191.32		36.91		430.34		26.93	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
Aluminum	6.2	7	<0.2	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	<0.01	<0.01	0.03	0.03	0.02	0.01	<0.01	0.01	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	41.3	39.6	26.8	27	10.4	10.5	123	119	9.84	9.46
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.02	0.03	<0.01	<0.01	<0.01	<0.01	0.07	0.07	<0.01	<0.01
Copper	0.67	0.67	<0.01	<0.01	<0.01	<0.01	1.65	9.06	<0.01	<0.01
Iron	22.6	38.5	<0.03	0.08	<0.03	<0.03	0.18	0.93	<0.03	<0.03
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01
Magnesium	9.9	9.7	29.8	30.2	2.6	2.6	32.7	32.4	0.9	0.8
Manganese	0.126	0.121	0.266	0.265	<0.005	<0.005	0.053	0.062	<0.005	<0.005
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	0.06	0.07	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.07	0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	<2	<2	<2	<2	4	5	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	16.2	16.1	1.52	1.49	1.13	1.12	6.05	7.03	1.36	1.28
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	3	3	<2	<2	<2	<2	6	6	<2	<2
Strontium	0.098	0.094	0.288	0.284	0.149	0.144	0.305	0.294	0.037	0.036
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	0.011	0.011	0.02	0.02	0.022	0.019	0.029	0.038	<0.005	<0.005

SMITHERS REGION

MINE SITE NAME	**SULTANA**		**EMERALD GLACIER**		**MARMOT**		**PORTER-IDAHO**		**DUNWELL**	
Date (yy mm dd)	00 08 15		00 08 16		00 08 19		00 08 19		00 08 19	
Sample type	Adit drainage		Adit drainage		Adit drainage		Adit drainage		Adit drainage	
pH	3.54		6.73		7.2		7.3		6.89	
SO4 (ppm)	78		30		16		15		118	
Hardness (ppm)	23.53		88.43		44.31		62.67		154.4	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**1.8**
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	0.02	0.02	0.04	0.04	<0.01	<0.01	0.02	0.02	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	**0.07**	**0.09**
Calcium	8.28	8.1	24.1	23.4	14.7	15.1	18.4	19	55.2	56.7
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	**0.56**	**0.48**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.27**
Iron	**0.22**	**7.52**	<0.03	0.26	<0.03	0.08	<0.03	<0.03	0.04	**7.61**
Lead	<0.05	<0.05	<0.05	0.16	<0.05	<0.05	<0.05	<0.05	<0.05	**0.14**
Lithium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	0.9	0.8	7.5	7.3	1.6	1.6	3.6	3.7	4	4
Manganese	0.008	0.011	0.032	0.088	<0.005	0.006	<0.005	<0.005	**0.789**	**0.866**
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	2.02	2.18	1.49	1.46	1.08	1.08	2.05	2.04	3.3	4.18
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	<2	<2	3	3	<2	<2	<2	<2	3	3
Strontium	0.076	0.07	0.571	0.551	0.079	0.08	0.38	0.382	0.37	0.371
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	**0.036**	0.029	**4.19**	**4.22**	0.01	0.007	**0.083**	**0.084**	**7.44**	**11.9**

KAMLOOPS REGION

MINE SITE NAME	**WAYSIDE**		**CONGRESS**		**TWIN LAKES**		**WINDPASS**		**SWEETHOME**		
Date (yy mm dd)	00 09 05		00 09 05		00 09 07		00 09 08		00 09 08		
Sample type	Adit drainage		Adit drainage		Adit drainage		Adit drainage		Adit drainage		
pH	8.49	*(LB00-1202)*	8.53	*(LB00-1303)*	7.98	*(LB00-1403)*	8.13	*(LB00-1507)*	8.01	*(LB00-1504)*	
SO4 (ppm)	94	*(LB00-1202)*	279	*(LB00-1303)*	81	*(LB00-1403)*	56	*(LB00-1507)*	88	*(LB00-1504)*	
Hardness (ppm)	193.96		282.24		324.17		122.52		181.25		
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Dissolved	Total
(sample ID #)	*(LB00-1201)*	*(LB00-1203)*	*(LB00-1302)*	*(LB00-1301)*	*(LB00-1401)*	*(LB00-1402)*	*(LB00-1506)*	*(LB00-1505)*	*(LB00-1502)*	*(LB00-1503)*	*(LB00-1501)*
Aluminum	<0.2	0.3	<0.2	<0.2	<0.2	0.5	<0.2	<0.2	<0.2	<0.2	0.7
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	0.2	0.4	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	<0.01	<0.01	0.02	0.02	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	6	6.1	7.5	7.6	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	43.3	43.6	48.7	49.1	88	82.6	40.2	37.2	62.3	62	60.2
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.15	0.15	0.54
Iron	<0.03	0.48	<0.03	<0.03	<0.03	0.62	<0.03	0.18	<0.03	<0.03	0.69
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	<0.01	0.02	0.02	0.02	0.03	0.01	<0.01	0.01	<0.01	<0.01
Magnesium	20.5	20.6	37.5	38.9	31.3	28.7	7.9	7.2	8.1	8.1	7.5
Manganese	<0.005	0.012	0.007	0.008	<0.005	0.076	<0.005	0.017	0.156	0.154	0.159
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	3	2	3	4	<2	<2	<2	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	7.17	7.48	5.85	6.11	4.7	5.39	8.02	7.79	5.53	5.55	4.75
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	40	38	122	124	5	4	22	20	14	14	13
Strontium	0.376	0.374	0.802	0.822	0.804	0.762	0.044	0.042	0.096	0.096	0.095
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	0.02	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	<0.005	0.016	<0.005	<0.005	<0.005	0.009	<0.005	0.007	0.008	0.01	0.024

KAMLOOPS REGION

MINE SITE NAME	KAMAD						ENTERPRISE	
Date (yy mm dd)	00 09 08						00 09 09	
Sample type	Lower adit		Upper adit (Homestake Crk)		Homestake Crk. @ foot of property		Adit drainage	
pH	3.35		3.00		7.90		8.21	
SO4 (ppm)	7770		1660		36		2910	
Hardness (ppm)	6096		1131.9		192.53		2212.7	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
Aluminum	7.4	8	2.9	2.8	<0.2	<0.2	<0.2	<0.2
Antimony	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	<0.02	<0.02	<0.01	<0.01	0.02	0.02	0.01	0.02
Beryllium	<0.01	<0.01	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<2	<2	<0.1	<0.1	<0.1	<0.1	<0.6	<0.6
Boron	<0.2	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.02	<0.02	0.06	0.07	<0.01	<0.01	<0.01	<0.01
Calcium	349	372	190	192	47	47	108	111
Chromium	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.05	0.05	0.06	0.07	<0.01	<0.01	<0.01	<0.01
Copper	0.03	0.04	1.17	1.2	<0.01	<0.01	<0.01	0.01
Iron	19.1	21.5	40.5	83	<0.03	0.32	<0.03	<0.03
Lead	<0.1	<0.1	0.42	0.46	<0.05	<0.05	<0.05	<0.05
Lithium	0.21	0.22	0.02	0.02	<0.01	<0.01	0.06	0.06
Magnesium	1200	1260	160	159	18.8	18.3	462	472
Manganese	44.3	46.4	12.7	13.2	<0.005	0.012	<0.005	<0.005
Molybdenum	<0.06	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.1	<0.1	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.6	<0.6	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<4	<4	<2	<2	<2	<2	54	54
Selenium	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	14.9	12.8	5.05	5.27	4.53	4.87	5.95	6.36
Silver	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	437	461	15	15	3	3	415	423
Strontium	2.27	2.39	1.66	1.7	0.224	0.228	3.12	3.23
Thallium	<0.4	<0.4	<0.2	<0.2	<0.2	<0.2	0.2	<0.2
Tin	<0.06	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.02	<0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.06	<0.06	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	1.33	1.41	30.1	31.5	<0.005	0.006	0.026	0.032

CRANBROOK REGION

MINE SITE NAME	**PHOENIX**		**MOTHERLODE**		**SPITZEE**		**GOPHER**	
Date (yy mm dd)	00 09 11		00 09 12		00 09 12		00 09 13	
Sample type	Tailings pond		Flooded open pit		Adit drainage		Adit drainage	
pH	8.00	*(LB00-1803)*	7.98	*(LB00-1903)*	8.03	*(LB00-2003)*	7.91	*(LB00-2103)*
SO4 (ppm)	637	*(LB00-1803)*	823	*(LB00-1903)*	300	*(LB00-2003)*	76	*(LB00-2103)*
Hardness (ppm)	796.28		901.59		390.89		219.26	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-1801)*	*(LB00-1802)*	*(LB00-1901)*	*(LB00-1902)*	*(LB00-2001)*	*(LB00-2002)*	*(LB00-2101)*	*(LB00-2102)*
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	0.2	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	0.01	0.01	<0.01	0.01	0.02	0.02	<0.01	0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	269	268	218	205	131	127	78.1	77.7
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01
Iron	<0.03	0.04	<0.03	0.15	<0.03	0.17	<0.03	0.04
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	<0.01	0.01	0.02	0.01	0.01	<0.01	<0.01
Magnesium	31	30.8	100	94.9	18.4	17.9	6.1	6.1
Manganese	<0.005	<0.005	0.008	0.039	0.184	0.175	0.016	0.017
Molybdenum	<0.03	<0.03	0.25	0.24	<0.03	<0.03	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	3	3	3	4	4	4	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	5.46	5.43	5.9	5.61	7.71	7.62	8.11	8.16
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	7	6	47	44	14	14	5	5
Strontium	1.84	1.81	9.93	9.23	0.989	0.958	0.608	0.609
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	<0.005	<0.005	0.006	0.012	<0.005	0.005	0.052	0.053

CRANBROOK REGION

MINE SITE NAME	SECOND RELIEF					YMIR TAILINGS		KOOTENAY FLORENCE	
Date (yy mm dd)	00 09 13					00 09 13		00 09 14	
Sample type	Adit drainage		Drainage from toe of dump			Pond on tailings		Adit drainage	
pH	8.00	*(LB00-2307)*	6.81	*(LB00-2304)*		4.92	*(LB00-2403)*	7.73	*(LB00-2503)*
SO4 (ppm)	16	*(LB00-2307)*	45	*(LB00-2307)*		410	*(LB00-2403)*	412	*(LB00-2503)*
Hardness (ppm)	74.94		47.85			348.72		580.2	
Metals (ppm)	Dissolved	Total	Dissolved	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-2305)*	*(LB00-2306)*	*(LB00-2301)*	*(LB00-2303)*	*(LB00-2302)*	*(LB00-2401)*	*(LB00-2402)*	*(LB00-2501)*	*(LB00-2502)*
Aluminum	<0.2	<0.2	<0.2	<0.2	0.3	2.6	2.8	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	<0.01	<0.01	<0.01	<0.01	0.01	0.04	0.04	<0.01	0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	0.82	0.87	<0.01	<0.01
Calcium	29.1	28.5	17.1	17.5	17.5	106	108	207	196
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.02	<0.01	<0.01
Copper	<0.01	<0.01	0.02	0.02	0.02	0.02	0.02	<0.01	<0.01
Iron	<0.03	0.05	0.1	0.13	0.6	0.73	6.43	<0.03	7.13
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	0.41	0.49	<0.05	<0.05
Lithium	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.02	0.02
Magnesium	1	0.9	0.9	0.9	1	19	19.2	23.1	22
Manganese	<0.005	<0.005	0.198	0.096	0.156	2.14	2.18	2.29	2.11
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	<2	<2	<2	<2	2	3	3
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	4.08	4.04	4.03	4.12	4.22	8.3	8.5	7.17	7.18
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	2	2	<2	<2	<2	2	3	4	3
Strontium	0.094	0.092	0.051	0.052	0.051	0.51	0.52	0.967	0.914
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	0.011	0.015	0.041	0.044	0.043	25.1	25.8	1.47	1.54

CRANBROOK REGION

MINE SITE NAME	HIGHLAND		CANEX TAILINGS		MIDWAY				CORK-PROVINCE	
Date (yy mm dd)	00 09 14		00 09 14		00 09 14				00 09 19	
Sample type	Adit drainage		Pond at foot of tailings		Upper adit drainage		Lower adit drainage (at foot of dump)		Adit drainage	
pH	7.41	(LB00-2603)	8.11	(LB00-2703)	3.85	(LB00-2803)	3.3	(LB00-2806)	8.05	(LB00-2903)
SO4 (ppm)	497	(LB00-2603)	37	(LB00-2703)	160	(LB00-2803)	256	(LB00-2806)	36	(LB00-2903)
Hardness (ppm)	557.06		104.3		93.67		150.17		113.8	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-2601)*	*(LB00-2602)*	*(LB00-2701)*	*(LB00-2702)*	*(LB00-2801)*	*(LB00-2802)*	*(LB00-2804)*	*(LB00-2805)*	*(LB00-2902)*	*(LB00-2901)*
Aluminum	<0.2	1	<0.2	0.4	0.3	0.4	0.8	1	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	0.6	<0.2	<0.2	<0.2	<0.2
Barium	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.02	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	170	171	35.6	32.7	23.2	23.2	43.3	41.7	39.9	36.5
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.01	0.01	<0.01	<0.01	0.01	0.01	0.02	0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	0.05	0.06	<0.01	<0.01	<0.01	<0.01
Iron	0.87	11.4	<0.03	0.28	2.71	17.4	3.28	20.5	<0.03	0.1
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	0.03	0.03	<0.01	<0.01	<0.01	0.01	0.02	0.01	<0.01	<0.01
Magnesium	31.1	31.6	6.1	5.5	8.7	8.7	11.9	11.2	5.8	5.5
Manganese	8.2	8.03	<0.005	0.011	2.6	2.6	5.49	5.25	0.021	0.021
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	0.07	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	<2	<2	2	3	4	3	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	5.57	6.28	5.37	5.11	12.7	12.4	18.8	18.2	3.53	3.5
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	2	2	5	4	8	8	11	11	<2	<2
Strontium	0.701	0.712	0.14	0.128	0.086	0.083	0.162	0.161	0.59	0.541
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	6.59	6.98	0.013	0.028	0.62	0.614	0.752	0.703	0.919	0.875

CRANBROOK REGION

MINE SITE NAME	CAMBORNE		JACKSON				SLOCAN SOVEREIGN		RENO	
Date (yy mm dd)	00 09 18		00 09 19				00 09 19		00 09 20	
Sample type	Adit - stagnant water		Adit drainage - 1862 m		Adit drainage - 1770 m		Adit drainage		Adit drainage	
pH	5.4	*(LB00-3003)*	8.09	*(LB00-3103)*	8.11	*(LB00-3106)*	8.09	*(LB00-3203)*	8.03	*(LB00-3303)*
SO4 (ppm)	434	*(LB00-3003)*	106	*(LB00-3103)*	74	*(LB00-3106)*	106	*(LB00-3203)*	11	*(LB00-3303)*
Hardness (ppm)	269.69		259.46		193.84		243.69		43.95	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-3002)*	*(LB00-3001)*	*(LB00-3102)*	*(LB00-3101)*	*(LB00-3105)*	*(LB00-3104)*	*(LB00-3202)*	*(LB00-3201)*	*(LB00-3302)*	*(LB00-3301)*
Aluminum	0.3	0.4	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	<0.01	<0.01	0.02	0.02	0.02	0.01	0.02	0.02	<0.01	0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	0.36	0.36	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01
Calcium	59.8	53.1	59.5	53.6	53.4	49	62	59.1	15.8	14.3
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	0.05	0.04	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	0.52	0.52	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	0.06	0.22	<0.03	0.09	<0.03	<0.03	<0.03	0.03	<0.03	0.06
Lead	2.76	3.19	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	36.2	33.4	33.4	30.6	18.8	17.4	24.5	23.4	2.2	2
Manganese	3.92	3.65	0.009	0.014	<0.005	<0.005	0.009	0.008	<0.005	0.01
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	0.11	0.11	0.05	0.07	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	5.48	5.38	2.5	2.43	2.63	2.55	2.9	2.9	2.84	2.75
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	<2	<2	<2	<2	<2	<2	2	<2	<2	<2
Strontium	0.344	0.292	0.546	0.491	0.479	0.44	1.32	1.26	0.068	0.062
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	76.8	72.6	0.608	0.607	1.17	1.1	0.213	0.207	0.033	0.035

PRINCE GEORGE REGION

MINE SITE NAME	TAKLA SILVER		BRALORNE TAKLA		SNOWBIRD		CARIBOO HUDSON	
Date (mm dd yy)	9/25/00		9/25/00		9/26/00		9/27/00	
Sample type	adit drainage		Flooded shaft		Flooded decline		adit drainage	
pH	7.76	*(LB00-3403)*	7.82	*(LB00-3504)*	7.84	*(LB00-3603)*	8.19	*(LB00-3804)*
SO4 (ppm)	55	*(LB00-3403)*	7	*(LB00-3504)*	492	*(LB00-3603)*	5	*(LB00-3804)*
Hardness (ppm)	228.04		211.14	*Hg (LB00-3503)*	1173.2		67.54	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-3402)*	*(LB00-3401)*	*(LB00-3502)*	*(LB00-3501)*	*(LB00-3602)*	*(LB00-3601)*	*(LB00-3802)*	*(LB00-3801)*
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	0.6	0.6	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	0.2	<0.2	<0.2	<0.2	0.4	<0.2	<0.2
Barium	<0.01	<0.01	0.1	0.1	0.01	0.02	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.2	<0.2	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	65.6	67.6	50.4	79.7	135	138	15.3	15.7
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	<0.03	0.35	0.25	0.96	<0.03	3.21	<0.03	0.1
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	14.5	14.4	2.9	2.9	203	202	6.9	6.9
Manganese	0.027	0.037	<0.005	0.051	0.342	0.355	<0.005	0.009
Mercury	-	-	-	0.0015	-	-	-	-
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	0.09	0.13	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<2	<2	<2	<2	<2	<2	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	1.48	1.6	1.61	1.93	9.74	10.2	1.23	1.32
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	<2	<2	<2	<2	12	12	<2	<2
Strontium	0.073	0.078	0.046	0.055	1.43	1.48	0.051	0.056
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	0.365	0.44	0.068	0.108	<0.005	<0.005	<0.005	0.006

PRINCE GEORGE REGION

MINE SITE NAME	JIM		JANE/SNOWSHOE		MIDAS		WARSPITE	
Date (mm dd yy)	9/27/00		9/27/00		9/27/00		9/28/00	
Sample type	adit drainage		composite upper/lower portal		adit drainage		adit drainage	
pH	8.03	*(LB00-3903)*	8.13	*(LB00-4003)*	8.1	*(LB00-4103)*	8.18	*(LB00-4203)*
SO4 (ppm)	14	*(LB00-3903)*	9	*(LB00-4003)*	27	*(LB00-4103)*	40	*(LB00-4203)*
Hardness (ppm)	98.59		70.98		191.11		160.69	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-3902)*	*(LB00-3901)*	*(LB00-4002)*	*(LB00-4001)*	*(LB00-4102)*	*(LB00-4101)*	*(LB00-4202)*	*(LB00-4201)*
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	0.03	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	15	15	15.7	15.6	40.4	40.2	30.1	30
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	<0.03	0.26	<0.03	0.21	<0.03	<0.03	<0.03	5.18
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	14.9	14.9	7.7	7.8	22.3	22.1	21.1	20.9
Manganese	<0.005	0.023	<0.005	0.014	<0.005	<0.005	0.104	0.249
Molybdenum	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.03	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.05	<0.05	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<0.3	<0.3	<2	<2	<2	<2	<2	<2
Selenium	<2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	<0.2	<0.2	1.79	1.95	2.86	2.83	2.09	2.32
Silver	2.34	2.38	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	<0.01	<0.01	<2	<2	<2	<2	<2	<2
Strontium	<2	<2	0.046	0.05	0.097	0.099	0.123	0.127
Thallium	0.085	0.088	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.2	<0.2	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.03	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.01	<0.01	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	<0.03							
Zinc		<0.03	<0.005	0.006	0.006	0.01	0.007	0.081

PRINCE GEORGE REGION

MINE SITE NAME	**JIM**		**JANE/SNOWSHOE**		**MIDAS**		**WARSPITE**	
Date (mm dd yy)	9/27/00		9/27/00		9/27/00		9/28/00	
Sample type	adit drainage		composite upper/lower portal		adit drainage		adit drainage	
pH	8.03	*(LB00-3903)*	8.13	*(LB00-4003)*	8.1	*(LB00-4103)*	8.18	*(LB00-4203)*
SO4 (ppm)	14	*(LB00-3903)*	9	*(LB00-4003)*	27	*(LB00-4103)*	40	*(LB00-4203)*
Hardness (ppm)	98.59		70.98		191.11		160.69	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-3902)*	*(LB00-3901)*	*(LB00-4002)*	*(LB00-4001)*	*(LB00-4102)*	*(LB00-4101)*	*(LB00-4202)*	*(LB00-4201)*
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	0.03	0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	15	15	15.7	15.6	40.4	40.2	30.1	30
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	<0.03	0.26	<0.03	0.21	<0.03	<0.03	<0.03	5.18
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	14.9	14.9	7.7	7.8	22.3	22.1	21.1	20.9
Manganese	<0.005	0.023	<0.005	0.014	<0.005	<0.005	0.104	0.249
Molybdenum	-	-	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.03	<0.03	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.05	<0.05	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	<0.3	<0.3	<2	<2	<2	<2	<2	<2
Selenium	<2	<2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	<0.2	<0.2	1.79	1.95	2.86	2.83	2.09	2.32
Silver	2.34	2.38	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	<0.01	<0.01	<2	<2	<2	<2	<2	<2
Strontium	<2	<2	0.046	0.05	0.097	0.099	0.123	0.127
Thallium	0.085	0.088	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.2	<0.2	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.03	<0.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.01	<0.01	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
	<0.03							
Zinc		<0.03	<0.005	0.006	0.006	0.01	0.007	0.081
	0.007	0.018						

PRINCE GEORGE REGION

MINE SITE NAME	**ISLAND MOUNTAIN**				**CARIBOO GOLD QUARTZ**	
Date (mm dd yy)	9/29/00				9/29/00	
Sample type	drainage - ventilation house		main adit drainage		adit drainage	
pH	7.52	*(LB00-4303)*	8.17	*(LB00-4306)*	8.01	*(LB00-4403)*
SO4 (ppm)	1060	*(LB00-4303)*	45	*(LB00-4306)*	225	*(LB00-4403)*
Hardness (ppm)	1295.8		250.14		327.45	
Metals (ppm)	Dissolved	Total	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-4302)*	*(LB00-4301)*	*(LB00-4305)*	*(LB00-4304)*	*(LB00-4402)*	*(LB00-4401)*
Aluminum	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Antimony	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Barium	0.01	0.01	0.03	0.03	0.02	0.04
Beryllium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Calcium	251	251	58.2	58.4	64.5	66.2
Chromium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cobalt	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Copper	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Iron	<0.03	13.5	<0.03	<0.03	<0.03	19.5
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Magnesium	162	163	25.5	25.4	39.3	39.5
Manganese	1.12	1.11	<0.005	<0.005	0.205	0.555
Molybdenum	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Nickel	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Potassium	3	3	<2	<2	<2	<2
Selenium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Silicon	4.57	5.01	3.41	3.38	2.28	3.31
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	5	5	<2	<2	<2	<2
Strontium	1.31	1.3	0.327	0.328	0.28	0.297
Thallium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Zinc	0.012	0.022	0.005	0.007	<0.005	0.031

NANAIMO REGION

MINE SITE NAME	**LENORA**			
Date (mm dd yy)	11/23/00			
Sample type	stream at edge of dump		waste rock dump seep	
pH	7.52	*(LB00-4503)*	4.75	*(LB00-4506)*
SO4 (ppm)	9	*(LB00-4503)*	470	*(LB00-4506)*
Hardness (ppm)	28.515		371.48	
Metals (ppm)	Dissolved	Total	Dissolved	Total
(sample #)	*(LB00-4501)*	*(LB00-4502)*	*(LB00-4504)*	*(LB00-4505)*
Aluminum	<0.2	<0.2	5.8	16.1
Antimony	<0.2	<0.2	<0.2	<0.2
Arsenic	<0.2	<0.2	<0.2	<0.2
Barium	0.04	0.04	0.01	3.13
Beryllium	<0.005	<0.005	<0.005	<0.005
Bismuth	<0.1	<0.1	<0.1	<0.1
Boron	<0.1	<0.1	<0.1	<0.1
Cadmium	<0.01	<0.01	0.13	0.12
Calcium	9.93	9.93	110	103
Chromium	<0.01	<0.01	<0.01	0.01
Cobalt	<0.01	<0.01	0.02	0.02
Copper	0.04	0.04	10.7	10.6
Iron	0.2	0.2	<0.03	47.7
Lead	<0.05	<0.05	0.05	2.2
Lithium	<0.01	<0.01	<0.01	<0.01
Magnesium	0.9	0.9	25.5	27.8
Manganese	<0.005	<0.005	1.48	1.55
Molybdenum	<0.03	<0.03	<0.03	0.05
Nickel	<0.05	<0.05	<0.05	<0.05
Phosphorus	<0.3	<0.3	<0.3	0.7
Potassium	<2	<2	<2	5
Selenium	<0.2	<0.2	<0.2	<0.2
Silicon	2.41	2.41	8.2	10.9
Silver	<0.01	<0.01	<0.01	0.03
Sodium	<2	<2	3	3
Strontium	0.022	0.022	0.298	0.328
Thallium	<0.2	<0.2	<0.2	<0.2
Tin	<0.03	<0.03	<0.03	<0.03
Titanium	<0.01	<0.01	<0.01	0.18
Vanadium	<0.03	<0.03	<0.03	0.03
Zinc	0.319	0.319	28.8	26.4

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